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ABSTRACT

Based on a 1974 survey of over 1500 higher education institutions, data are presented that project professional computer manpower availability. Statistics for 1966 to 1979 are provided on associates, bachelors, masters, and doctoral degree programs in computer science, data processing, information science, etc.; majors enrolled; numbers of degree programs and graduates in computer fields; estimates of manpower produced by postsecondary vocational education institutions; estimated distribution of computer staff by level of education desired for replacements (overall and by state) and of computer installations by state; estimated manpower utilization by academic departments for programs in computer science, and by computer centers in U.S. colleges and universities; and computer manpower needs and estimated production by postsecondary institutions by state. Large numbers of personnel are shown to have been able to enter the computer manpower pool in the past with little training. It is noted that large amounts of federal and state funds were poured into the vocational and two-year programs, but that there should be a weeding out of the weakest postsecondary programs. Secondary schools should provide enough computer education so that the student can learn to live comfortably in a computer-assisted environment and also to judge whether they wish to pursue a postsecondary program of study. The names of institutions reporting the offer of degree programs are appended, including the name of the degree program, the department name, majors enrolled, and graduates for 1976-1977. (CC)

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Computer Manpower-Supply and Demand-by States 1979

John W. Hamblen

Computer Manpower-Supply and Demand - by States

Third Edition
1979

by

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Preface

In the preface of the first edition I stated that the cause of many of the problems associated with computer usage is the "overutilization of undereducated people." The reason being, of course, that properly educated people have not been available. Bootstrapping by training existing personnel and pirating whatever others centers had trained was the only way that staff could be obtained during the late fifties and the early sixties. The late sixties saw the tremendous growth in the one and two-year programs aided by large infusions of federal monies via the Office of Education programs. The production of these programs crested around 1972 at a peak of nearly 28,000 during that year dropped to about 20,000 for 1975 and are now up again to over 27,000. The seventies might well become known as the decade of the recognition of the value of the college graduate to effective and efficient computer usage. Based upon my estimate of need and the present average rate of growth (about 16%) in the production of graduates of four-year programs it will take nearly twelve years to match the need and production.

The main point here is that it will be sometime before we need to worry about a "glut" in the market for four-year graduates in the computer related areas. At the master's level, the rate of growth was about half that of the four-year production rate prior to 1976-77. However 1976-77 production was below the 1974-75 estimates. At the doctorate level we also have a drop in production below 1973-74 levels. Production of doctorates is only 26% or about 1 out of 4 needed.

All of my estimates are based upon the expectation that the professors in colleges and universities will seek out the advice of representatives of industry as to industries' needs and keep the educational programs aligned with those needs. They cannot afford to do otherwise.

It is my intent then to present estimates of computer manpower based upon the best data available, classified by job classifications and level of education, which I believe will be required for replacement of current personnel and to fill new positions. Better data is available on manpower production than on utilization through data collected under support from the National Science Foundation. Data from the Bureau of Adult, Vocational, and Technical Education of the U.S. Office of Education are also utilized. Manpower production is then matched against estimated needs. Wherever possible, data relating to the States, individually and collectively, are reported. It is hoped that the net result will be useful to states, institutions, and federal agencies for planning purposes.

Throughout the paper I have attempted to make my assumptions and subsequent model as transparent as possible. If my readers feel that their information or intuition is better, they can adjust the assumptions and make their own estimates of manpower needs.

John W. Hamblen
January, 1979

COMPUTER MANPOWER - SUPPLY AND DEMAND - BY STATES

Background

This is the third publication (1) presenting estimates of the demand for computer manpower by states based upon a static model developed by the author and estimates of production of computer manpower by the U.S. Post Secondary Institutions also on a state basis. The previous reports have been published in the ACM/SIGCSE Bulletin (2, 3).

During the period 1966-72 while the author was Project Director for Computer Sciences at the Southern Regional Education Board (SREB), he conducted three surveys on Computers in U.S. Higher Education including their utilization and related educational programs. These studies were supported by the National Science Foundation and resulted in three publications (4, 5, 6). The first was published by the SREB and the latter two by the National Science Foundation.

The first study was a survey using a stratified random sample of 739 institutions, from a population of 2,219, selected by systematic random sampling within strata by the U.S. Office of Education. Six hundred sixty-nine or 92 percent of the institutions in the sample responded.

The base year for data collection was 1964-65 and projections were requested from the institutions for 1968-69. The data collection instrument was designed by the Mathematical Sciences Section of NSF to meet their existing program needs for planning. Consequently, emphasis was placed upon the financial aspects of college and university computer center operations and only limited information was gathered with regard to manpower training and utilization.

The second survey was much more comprehensive and was sent to all institutions of higher education listed on the U.S. Office of Education's Higher Education General Information Survey (HEGIS) file. Nineteen hundred sixty-five or 79 percent of the 2,477 institutions responded. The data collection forms were designed with the advice and counsel of thirty or more national professional and institutional associations and government agencies. The base year for reporting data was 1966-67.

Extensive modifications were made in the data collection forms for the third survey. The base year was 1969-70.

During 1974 the author sent questionnaire to 2,520 institutions of higher education (seminaries, conservatories and special schools were not included) to update the data obtained on degree programs in the 1969-70 survey. A 61% rate of response resulted and the production estimates for 1973-74 and 1974-75 were obtained (1).

Production estimates for 1976-77 were obtained from data collected by the Computer Science Department of the University of Missouri - Rolla under NSF Grant SED #75 17157 (7) and from data obtained from the U.S. Office of Education (8).

Assessment Problems

Problems resulting from lack of standardization in the computer industry are well-known. Unfortunately, the educational and occupational nomenclature also suffers this malady. The shifting of terms and definitions over the years can inject disastrous consequences on estimates and, particularly, projections. Attempts to make comparisons with other studies become even more hazardous.

Manpower Production

Educational programs in Computer Science, Data Processing, Information Science, etc., exist in institutions of higher education at all levels. Two year programs terminate with an associate degree and four year programs with a bachelor's degree. Master's and doctorate programs exist at many institutions (see Appendix A for list). Although computer science and data processing are by far the most popular names (see Table I), there appears still to be far too many different names used for educational programs in institutions of higher education. Further consolidation is necessary to ensure a healthy and unified development of the disciplines. The efforts of the ACM Curriculum Committee on Computer Science (9, 10) and the ACM Committee on Computer Education for Management (11, 12) have and will continue to have a unifying influence on academic programs in computer and information science. The early work of these committees was partially supported by the National Science Foundation.

TABLE I – Reported Degree Programs in Computer Science, Data Processing, Information Science, etc. for Academic Years 1966-67, 1969-70, 1973-74, 1976-77, 1977-78 and 1978-79.

	Associate						Bachelor's					
Program Name	66-67	69-70	73-74	76-77	77-78	78-79	66-67	69-70	73-74	76-77	77-78	78-79
Data Processing: Total	122	204	119	179	183	184	15	21	16	27	27	27
In Departments of:												
Data Processing	122	136	69	110	112	112	11	5	6	8	8	8
Business Administration	0	34	23	34	35	35	1	11	7	15	15	15
Business		17	19	14	14	14		2	1	3	3	3
Miscellaneous	0	17	8	21	22	23	3	3	2	1	1	1
Computer Science: Total	8	33	33	64	64	65	50	90	118	181	197	199
In Departments of:												
Computer Science	7	20	16	32	32	33	30	40	69	100	106	108
Mathematics	0	0	1	10	10	10	7	19	19	27	31	31
Electrical Engineering	0	0	0	0	0	0	8	8	4	2	2	2
Computer and Information Science		1	0	1	1	1		1	4	10	13	13
Mathematical Sciences				2	2	2				20	20	20
Miscellaneous	1	12	16	19	19	19	5	24	22	22	25	25
Computer Programming: Total	4	38	23	36	37	37	0	6	1	4	4	4
In Departments of:												
Data Processing		22	15	11	11	11	0	1	1	0	0	0
Computer Programming	4	5	3	8	8	8	0	0	0	1	1	1
Miscellaneous		11	5	17	18	18	0	5	0	3	3	3
Computer Technology: Total	8	21	14	12	12	12	1	9	3	1	1	1
Information Systems: Total	0	5	2	6	6	5	3	7	9	24	24	24
In Departments of:												
Information Systems				5	5	4				10	10	10
Miscellaneous		5	2	1	1	1		7	9	14	14	14
Information Science: Total	0	0	1	1	1	1	2	3	3	8	10	10
Computer Engineering: Total				1	1	1				7	8	9
In Departments of:												
Electrical Engineering				0	0	0				5	6	7
Miscellaneous				1	1	1				2	2	2
Computer Science and Engineering: Total				1	1	1				9	9	9
In Departments of:												
Electrical Engineering				0	0	0				6	6	6
Miscellaneous				1	1	1				3	3	3
Miscellaneous: Total		1	14	31	31	30	1	12	34	53	55	59
TOTAL (Reported)	142	302	205	331	336	336	72	148	184	314	335	342
Estimated Population Totals [1]	178	405	338	570	579	579	90	198	302	541	577	589

[1] Reported Totals x (Number Institutions in Population) / (Number Institutions Responding)

TABLE I — Reported Degree Programs in Computer Science, Data Processing, Information Science, etc: for Academic Years 1966-67, 1969-70, 1973-74, 1976-77, 1977-78 and 1978-79 (Cont.)

	Master's						Doctorate					
Program Name	66-67	69-70	73-74	76-77	77-78	78-79	66-67	69-70	73-74	76-77	77-78	78-79
Data Processing: Total	5	6	2	2	2	2	1	1	1	1	1	1
In Departments of:												
Data Processing	4	1	0	0	0	0	1	0	0	0	0	0
Business Administration	1	2	1	1	1	1	0	0	0	1	1	1
Business		2	0	1	1	1		0	0	0	0	0
Miscellaneous	0	1	1	0	0	0	0	1	1	0	0	0
Computer Science: Total	58	76	66	81	88	93	35	50	36	40	41	43
In Departments of:												
Computer Science	35	37	45	51	55	58	22	24	25	28	29	30
Mathematics	4	8	2	8	10	10	4	3	0	2	2	2
Electrical Engineering	9	12	5	2	2	2	6	9	4	1	1	1
Computer and Information Science		3	0	5	5	6		2	0	2	2	3
Mathematical Sciences				5	6	6				2	2	2
Miscellaneous	10	16	14	10	10	11	3	12	7	5	5	5
Computer Programming: Total	0	0	0	0	0	1	0	1	0	0	0	0
In Departments of:												
Data Processing			0	0	0	0		0	0	0	0	0
Computer Programming	0	0	0	0	0	0		0	0	0	0	0
Miscellaneous		0	0	0	0	1		1	0	0	0	0
Computer Technology: Total	0	3	0	0	0	0	0	2	0	0	0	0
Information Systems: Total	2	5	3	8	8	10	1	3	1	5	5	5
In Departments of:												
Information Systems				2	2	4				1	1	1
Miscellaneous	2	5	3	6	6	6		3	1	4	4	4
Information Science: Total	9	7	3	3	3	3	8	6	2	2	2	2
Computer Engineering: Total				6	7	7				3	3	4
In Departments of:												
Electrical Engineering				4	5	5				2	2	3
Miscellaneous				2	2	2				1	1	1
Computer Science and Engineering: Total				9	9	9				6	6	6
In Departments of:												
Electrical Engineering				4	4	4				3	3	3
Miscellaneous				5	5	5				3	3	3
Miscellaneous: Total	2	17	22	21	21	24	1	10	15	12	12	12
TOTAL (Reported)	78	116	96	130	138	149	46	73	55	69	70	73
Estimated Population Totals [1]	98	155	157	224	238	257	58	98	90	119	121	126

[1] Reported Totals x (Number Institutions in Population) / (Number Institutions Responding)

TABLE II — Reported Majors Enrolled for 1966-67, 1969-70, 1973-74 and 1976-77 and Degrees Awarded for 1966-67, 1969-70, 1973-74 and 1976-77

Undergraduate												
	No. Majors				Associate				Bachelor's			
Program Name	66-67	69-70	73-74	76-77	66-67	69-70	73-74	76-77	66-67	69-70	73-74	76-77
Data Processing	12815	27712	10985	22044	872	3285	1674	3058	74	286	277	380
Computer Science	3187	10909	13314	22632	62	259	462	663	355	976	2371	3417
Computer Programming	281	4786	1994	4103	78	688	481	591	0	12	28	35
Computer Technology	496	2791	1479	1789	13	218	211	149	20	60	64	9
Information Systems	737	1198	905	2252	0	66	1	76	19	91	218	390
Information Science	100	546	209	334	0	0	10	0	0	28	53	78
Computer and Information Science				1498				18				390
Computer Science and Engineering				1180				5				207
Miscellaneous	113	1249	3198	5230	—	0	108	241	7	195	619	714
Total	17729	49191	32084	61062	1025	4516	2947	4801	475	1648	3530	5520
Estimated Population Totals [1]	22161	65916	52597	105190	1281	6051	4831	8271	594	2208	5951	9509

[1] Reported Totals x (Number Institutions in Population) / (Number Institutions Responding)

TABLE II – Reported Majors Enrolled for 1966-67, 1969-70, 1973-74 and 1976-77 and Degrees Awarded for 1966-67, 1969-70, 1973-74 and 1976-77 (Cont.)

Graduate

Program Name	No. Majors				Master's				Doctorates			
	66-67	69-70	73-74	76-77	66-67	69-70	73-74	76-77	66-67	69-70	73-74	76-77
Data Processing	317	159	73	48	63	9	19	18	1	0	0	3
Computer Science	2925	4725	4954	5525	446	892	1101	1086	133	187	167	135
Computer Programming	0	63	20	0	0	0	0	0	0	0	0	0
Computer Technology	0	53	4	0	0	4	0	0	0	2	0	0
Information Systems	31	241	260	431	6	24	42	108	0	1	3	13
Information Science	627	240	199	338	64	34	52	125	3	11	0	3
Computer and Information Science				453				145				10
Computer Science and Engineering				754				146				18
Miscellaneous	48	1327	1876	777	15	113	527	207	2	28	55	18
Total	3949	6808	7391	8326	594	1076	1741	1835	139	229	225	200
Estimated Population Totals [1]	4936	9123	12116	14343	742	1442	2854	3161	174	307	369	345

[1] Reported Totals x (Number Institutions in Population / (Number Institutions Responding)

TABLE III
REPORTED NUMBERS OF DEGREE PROGRAMS AND NUMBERS OF GRADUATES IN COMPUTER FIELDS
1976-77

State	Associate		Bachelor's		Master's		Doctorate	
	Programs	Graduates	Programs	Graduates	Programs	Graduates	Programs	Graduates
Alabama	5	28	5	50	3	10	1	0
Alaska	0	0	0	0	0	0	0	0
Arizona	8	45	6	95	3	45	3	5
Arkansas	0	0	7	32	2	8	0	0
California	25	502	14	471	16	270	15	69
Colorado	6	68	4	30	2	20	2	2
Connecticut	4	88	4	26	1	15	0	0
Delaware	1	12	0	0	0	0	0	0
District of Col.	1	31	1	0	2	130	0	0
Florida	13	223	7	158	5	14	1	1
Georgia	9	26	3	93	3	72	3	5
Hawaii	1	15	0	0	0	0	0	0
Idaho	0	0	3	15	0	0	0	0
Illinois	16	272	18	394	6	102	4	34
Indiana	12	120	15	173	4	66	1	5
Iowa	4	158	9	148	2	28	2	11
Kansas	9	65	7	109	3	48	2	3
Kentucky	7	51	7	69	1	10	0	0
Louisiana	3	21	8	124	1	2	0	0
Maine	1	5	1	4	1	2	0	0
Maryland	8	161	9	188	3	48	3	11
Massachusetts	9	61	6	130	9	60	6	12
Michigan	19	308	10	180	6	67	4	5
Minnesota	2	11	8	235	4	70	3	8
Mississippi	7	42	6	94	3	16	0	0
Missouri	10	231	10	171	2	40	2	4
Montana	1	5	3	10	0	0	0	0
Nebraska	3	30	1	15	0	0	0	0
Nevada	0	0	0	0	0	0	0	0
New Hampshire	1	0	1	17	0	0	0	0
New Jersey	6	123	7	148	2	72	1	0
New Mexico	1	0	3	8	1	3	0	0
New York	22	298	19	485	10	155	3	0

TABLE III (CONT.)
REPORTED NUMBERS OF DEGREE PROGRAMS AND NUMBERS OF GRADUATES IN COMPUTER FIELDS
1976-77

State	Associate		Bachelor's		Master's		Doctorate	
	Programs	Graduates	Programs	Graduates	Programs	Graduates	Programs	Graduates
North Carolina	7	108	7	79	2	15	2	2
North Dakota	1	19	2	34	1	1	0	0
Ohio	15	262	17	413	8	125	2	8
Oklahoma	3	41	3	11	1	10	0	0
Oregon	6	65	2	38	1	19	0	0
Pennsylvania	20	328	24	386	5	55	2	8
Rhode Island	1	40	2	29	2	14	1	1
South Carolina	2	15	1	8	0	0	0	0
South Dakota	3	19	1	11	0	0	0	0
Tennessee	7	88	8	86	1	3	1	2
Texas	17	263	15	314	6	80	3	11
Utah	1	2	2	28	0	0	0	0
Vermont	0	0	0	0	0	0	0	0
Virginia	8	146	11	131	4	37	1	0
Washington	4	70	2	52	2	19	2	2
West Virginia	8	45	5	46	0	0	0	0
Wisconsin	9	256	7	139	3	84	3	5
Wyoming	2	3	1	10	0	0	[illegible]	0
Service Schools	0	0	1	21	0	0	0	0
Puerto Rico	2	15	2	12	0	0	0	0

TABLE IV
ESTIMATES OF COMPUTER MANPOWER PRODUCED BY POST-SECONDARY VOCATIONAL EDUCATION INSTITUTIONS

	Total 1977 Enrollment	(1) 1977* Post-Secondary Enrollment	(2) Estimated 1977 Post-Secondary Completions .30 x (1)	(3) Adjusted For Overlap with HEGIS .85 x (2)	No. Entering Computer Manpower Pool .75 x (3)	No. Continuing Education .10 x (3)
Alabama	1923	774	232	197	148	20
Alaska	486	293	88	75	56	8
Arizona	3752	3899	870	740	555	74
Arkansas	629	219	66	56	42	6
California	46452	29384	8815	7493	5620	749
Colorado	2698	1548	464	394	296	39
Connecticut	285	128	38	32	24	3
Delaware	674	210	63	54	41	5
District of Col.	0	0	0	0	0	0
Florida	8335	4230	1269	1079	809	108
Georgia	4826	1716	515	438	329	44
Hawaii	4416	517	155	132	99	13
Idaho	280	89	27	23	17	2
Illinois	22068	5614	1684	1431	1073	143
Indiana	2804	1161	348	296	222	30
Iowa	2017	950	285	242	182	24
Kansas	1661	612	184	156	117	16
Kentucky	769	238	71	60	45	6
Louisiana	3380	302	91	77	58	8
Maine	812	29	9	8	6	1
Maryland	7125	4103	1231	1046	785	105
Massachusetts	5317	983	295	251	188	25
Michigan	8866	4393	1318	1120	840	112
Minnesota	2934	702	211	179	134	18
Mississippi	1568	698	209	178	134	18
Missouri	3293	2036	611	519	389	52
Montana	341	269	81	69	52	7
Nebraska	794	321	96	82	62	8
Nevada	768	286	86	73	55	7
New Hampshire	448	62	19	16	12	2

TABLE IV (Cont.)
ESTIMATES OF COMPUTER MANPOWER PRODUCED BY POST-SECONDARY VOCATIONAL EDUCATION INSTITUTIONS

	Total 1977* Enrollment	(1) 1977* Post-Secondary Enrollment	(2) Estimated 1977 Post-Secondary Completions .30 x (1)	(3) Adjusted For Overlap With HEGIS .85 x (2)	No. Entering Computer Manpower Pool .75 x (3)	No. Continuing Education .10 x (3)
New Jersey	12090	2429	729	620	465	62
New Mexico	301	33	10	9	7	1
New York	17635	6394	1918	1630	1223	163
North Carolina	4691	2743	823	700	525	70
North Dakota	347	256	77	65	49	7
Ohio	4606	936	281	239	179	24
Oklahoma	2902	2125	638	542	407	54
Oregon	1472	1120	336	286	215	29
Pennsylvania	8897	1730	519	441	331	44
Rhode Island	705	135	41	35	26	4
South Carolina	1091	985	296	252	189	25
South Dakota	45	18	5	4	3	0
Tennessee	4065	2087	626	532	399	53
Texas	9241	6716	2015	1713	1285	171
Utah	1872	151	45	38	29	4
Vermont	121	0	0	0	0	0
Virginia	4794	1297	389	331	248	33
Washington	4526	1751	525	446	335	45
West Virginia	760	254	76	65	49	7
Wisconsin	6359	3159	948	806	605	81
Wyoming	363	277	83	71	53	7
American Samoa	0	0	0	0	0	0
Guam	2	0	0	0	0	0
Puerto Rico	151	151	45	38	29	4
Trust Territories	30	0	0	0	0	0
Virgin Islands	0	0	0	0	0	0
Totals	226745	99513	29856	25379	19041	2541

* USOE reported number

The number of majors enrolled in undergraduate programs and the numbers of graduates per year have doubled between 1973-74 and 1976-77 (see Table II). During the same period, the number of graduate majors increased by less than 20%, the number of master's degrees increased by only 10% and the number of Ph.D.'s awarded dropped slightly.

Table III gives the numbers of degree programs and graduates reported by the institutions of higher education in each of the fifty States for 1976-77. To obtain estimates of the total numbers of degree programs offered and total numbers of graduates, each of the reported totals were multiplied by the same factor, 1.72, (i.e. Total Number of Institutions/No. of Institutions Reporting). It should be pointed out that more than one program may be offered by a single institution.

Data on Post-Secondary Vocational Schools was obtained from the Bureau of Adult, Vocational, and Technical Education, Division of Vocational and Technical Education, USOE, HEW. There is some duplication of institutions in the data with those in the HEGIS file used for the higher education data. The Office of Education has recently developed a directory of vocational institutions. The post-secondary vocational enrollment and graduation figures were adjusted downward by 15% to allow for the duplication with the higher education figures.

Table IV is obtained by using data from a bulletin (8) dated January 1978, Vocational Education Information No. I, Fiscal Year 1976 and from state data for 1976-77 obtained directly from Mr. Harold F. Duis, Reports and Statistical Data Section, Division of Vocational and Technical Education.

The Office of Education reports (8) that 11.9% of those completing the post-secondary vocational program are unavailable for placement and 75.9% of those placed take jobs in the field for which they were trained or a related field. The net result is that 67% of those completing the post-secondary vocational program are placed in the job for which they were trained or a related field. Slightly over half (52.9%) of those unavailable for placement continue their education on a full-time basis. This would amount to about 6% of the total completions. We could argue that these percentages (67% and 6%) may be a little low for "Business Data Processing", "Scientific Data Technology", "Programmers" and "Computer and Console Operators", so let us use 75% and 10%. That is, three out of four of those completing the post-secondary program take jobs in a computer environment and one in ten continue their education. Since we do not have data on completions by state, we must estimate these. The post-secondary programs are primarily two-year programs. Therefore, no more than one-half of those enrolled in a given year should complete their program in that year. This is high due to drop-outs and extra length of time required for some students to finish. Thirty percent completions is probably closer and compares with data reported by Gilchrist and Weber. (12, 13)

COMPUTER MANPOWER DEMAND MODEL

Estimates of Current Computer Manpower

In order for us to estimate computer manpower needs, we must first estimate existing manpower so that we can project needs in terms of growth and replacement. Many of the graduates of the two-year programs will enter positions as librarians or data entry and peripheral operators, particularly at the supervisory levels simply because of supply and demand variations. I estimate that about 20% of these positions will be filled by persons with 2 years of college. Gilchrist and Weber estimated that there were 440,000 keypunch operators employed in the U.S. in 1970. With more efficient data-entry machines (magnetic tape and disk encoders) becoming wide-spread and the increased use of optical readers (OMR), I doubt that the number of keypunch operators has increased much. Assumng that each of the 35,000 (15) computer installations averaged one tape librarian and two high speed printer or peripheral and equipment operators, an estimate of 560,000 persons employed in this category is realistic. Therefore, 112,000 (20% x 560,000) jobs can be filled by persons with two years of college. (See Tables V and VI.) For the 35,000 computer installations in the U.S., I estimate that there is an average of three (3) administrators, five (5) analysts, three (3) systems programmers, seven (7) applications programmers and six (6) operators. (See Tables V and Table VI.) The previous estimate of 560,000 other operating personnel brings the average staff per installation to 40. This may appear a little high at first but we must keep in mind that each installation has on the average 2-½ computers, or looking at it in a different way, the estimated 35,000 computer installations include all of major installations, i.e., installations with medium and large scale computers. (many installations employ over 100 persons.)

TABLE V

Estimates of Computer Manpower Being Utilized in U.S.
January 1973

	Positions	College Education Required for Replacement
Management	105,000	105,000
Analysts	175,000	175,000
Systems Programmers	105,000	105,000
Applications Programmers	245,000	245,000
Operators	210,000	210,000
Other Operating Personnel	560,000	112,000
Total	1,400,000	952,000

Replacement Potential for College Graduates

The number of Ph.D.'s in Computer and Information Sciences required in staffing computer installations is difficult to estimate. For installations in the institutions of higher education four percent of the staff members held doctorates in 1966-67 thru 1976-77. Even though the numbers nearly doubled (711 to 1276) the percentages remained about the same. (See Tables XII and XIII) This percentage is higher than we would expect in general for computer installations. Even one percent, or 14,000, might be a little high and one-half percent (7000) a little low. Looking at it another way, if we assume that one out of five of the 35,000 installations average one Ph.D. per installation, this would be 7000 Ph.D.'s employed in computer installations. These are probably distributed between management and analysts in a ratio of about five to two, i.e., 5000 in management and 2000 as analysts (primarily operations research analysts). To these numbers we should add an additional 4000 (3522 for 1976-77) persons holding doctorates and employed by colleges and universities as professors and not associated with a computer installation. (See Table XI.)

The master's degree is quite common in the management, analysts and systems programmers categories, and not too uncommon among applications programmers. Some top supervisory positions in operations attract M.S. graduates in the computer and information sciences.

Table VI gives my estimate of the distribution of computer staff by level of education that I believe to be desired for replacement if an adequate supply of manpower is available at these levels. During the past years, companies have had to take what staff they could get and train or retrain them. This is an expensive route and therefore, I believe that given a choice, industry would prefer to hire trained personnel. In terms of formal education, I believe that we are overutilizing undereducated people in the computer related occupations.

Next we will construct similar estimates for the States with respect to total computer manpower by level of education desired for replacements. My basic assumption will be that non-higher education computer centers (hence staff) are distributed by States in the same proportion as higher education computer centers (staff) as reported in the 1976-77 NSF Inventory of Computers in Higher Education (7). Estimates for the number of computer installations in higher education in 1977 will then be obtained and related to the 35,000 U.S. computer installations estimated by Computers and Automation (15). (See Table VII).

By applying the percentages in Table VII to each of the entries in the Total row of Table VI, we get the Estimated Distribution of Computer Staff by Level of Education Desired for Replacements by States, 1976-77, (see Table VIII).

TABLE VI
ESTIMATED DISTRIBUTION OF COMPUTER STAFF BY LEVEL OF EDUCATION
REQUIRED OR DESIRED FOR REPLACEMENTS

	PS VOC and 2-year	4-year	M.S.	Ph.D.	Total	Percent of Total
Teaching	200	1,500	2,000	4,000*	7,700*	1
Management	5,000	37,000	60,000	5,000	105,000	11
Analysts	1,000	62,000	110,000	2,000	175,000	18
Systems Programmers	2,000	33,000	70,000	---	105,000	11
Applications Programmers	10,000	200,000	35,000	---	245,000	25
Operators	100,000	100,000	10,000	---	210,000	22
Other Operating Personnel	100,000	12,000	---	---	112,000	12
Total	216,200	445,500	287,000	11,000*	959,700	
Pecent of Total	23	46	30	1		

* Updated for 1976-77

TABLE VII
ESTIMATED DISTRIBUTION OF COMPUTER INSTALLATIONS BY STATES, 1976-77

State	Installations Reported for H.E. 1976-77	Estimated Number Installations for H.E. 76-77	% of all U.S.
Alabama	23	40	1.5
Alaska	1	2	.1
Arizona	49	67	2.5
Arkansas	14	21	.8
California	114	224	8.2
Colorado	20	33	1.2
Connecticut	21	37	1.4
Delaware	5	8	.3
District of Col.	10	17	.6
Florida	33	62	2.3
Georgia	25	49	1.8
Hawaii	3	12	.4
Idaho	3	9	.3
Illinois	75	142	5.2
Indiana	55	72	2.6
Iowa	34	66	2.4
Kansas	29	47	1.7
Kentucky	18	35	1.3
Louisiana	32	34	1.2
Maine	11	18	.7
Maryland	42	54	2.0
Massachusetts	62	121	4.4
Michigan	63	118	4.3
Minnesota	41	68	2.5
Mississippi	19	30	1.1
Missouri	54	64	2.3
Montana	14	17	.6
Nebraska	12	23	.8
Nevada	3	9	.3
New Hampshire	6	13	.5
New Jersey	40	62	2.3
New Mexico	3	6	.2
New York	105	253	9.3
North Carolina	40	73	2.7
North Dakota	8	10	.4
Ohio	62	98	3.6
Oklahoma	18	36	1.3
Oregon	26	39	1.4
Pennsylvania	92	138	5.0
Rhode Island	8	15	.5
South Carolina	24	44	1.6
South Dakota	6	7	.3
Tennessee	30	47	1.7
Texas	60	118	4.3
Utah	4	11	.4
Vermont	5	10	.4
Virginia	55	71	2.6
Washington	30	61	2.2
West Virginia	20	23	.8
Wisconsin	53	69	2.5
Wyoming	6	8	.3
Service Schools	3	9	.3
Canal Zone	0	0	.0
Guam	1	1	.0
Puerto Rico	7	11	.4
Virgin Islands	1	1	.0
TOTALS	1598	2733	99.8

Computer Manpower Utilization by Higher Education

Computer manpower utilization in institutions of higher education fall under three broad categories. One category is made up of personnel of academic departments offering degree programs. For this category, we have good estimates of the numbers of persons employed for 1969-70, 1973-74 and 1976-77 (see Tables IX, X and XI.) It is of interest to note that only about one out of every two faculty persons hold a doctorate and, of those who do, only one of three have a doctorate in computer science, information science, etc. This is not surprising because the supply of doctorates in these areas has been too small to fill the need. However, as the supply increases, replacements will be made from their ranks rather than from other fields.

The second category of computer manpower utilization in higher education is that of personnel required to man the computer facilities of the institutions. This includes facilities for all types of uses — research, administration and instruction. Since similar data was collected for both 1969-70 and 1976-77, some comparsions can be made or trends noticed. Table XII presents these data for 1969-70. Table XIII shows estimated manpower utilization for 1976-77 in the computer facilities of institutions of higher education. Only one in five B.S. degree holders were computer science majors while about one in four at the M.S. and one in six at the Doctorate levels had computer science or related degrees.

The third category of computer manpower is very difficult to estimate. These are mostly applications programmers, some operators and maintenance personnel who are scattered among the various departments (both academic and administrative) and are not on a computer center payroll. My estimates of such personnel during 1976-77 are 4000 applications programmers and 2000 others.

FUTURE COMPUTER MANPOWER NEEDS

The two principal factors which will determine future computer related manpower needs are replacement and growth. Replacement needs are largely due to deaths, retirement, change of field and emigration from the U.S.

Needs for Replacement

For 1971 the overall U.S. death rate was estimated (10) to be 9.3 per 1000 and had been dropping by .1 per year since 1968 with fluctuations from a maximum of 9.7 since 1949. An overall death rate of 9.1 is a reasonable estimate for 1973. However, this is too high for the current computer manpower population. Reference (16) also gives the death rates for white males as follows:

Age Group	Rate
15-24	1.7
25-34	1.7
35-44	3.3
45-54	8.5
55-64	21.6

TABLE VIII
ESTIMATED DISTRIBUTION OF COMPUTER STAFF BY LEVEL OF EDUCATION DESIRED FOR REPLACEMENTS BY STATES, 1976-77

State	Post Sec. Voc. and 2-year	4-year	M.S.	Ph.D.	Total
Alabama	3243	6683	4305	165	14396
Alaska	216	446	287	11	960
Arizona	5405	11138	7175	275	23993
Arkansas	1730	3564	2296	88	7678
California	17728	36531	23534	902	78695
Colorado	2594	5346	3444	132	11516
Connecticut	3027	6237	4018	154	13436
Delaware	649	1337	861	33	2879
District of Columbia	1297	2673	1722	66	5758
Florida	4973	10247	6601	253	22073
Georgia	3892	8019	5166	198	17275
Hawaii	865	1782	1148	44	3839
Idaho	649	1337	861	33	2879
Illinois	11242	23166	14924	572	49904
Indiana	5621	11583	7462	286	24952
Iowa	5189	10692	6888	264	23033
Kansas	3675	7574	4879	187	16315
Kentucky	2811	5792	3731	143	12476
Louisiana	2594	5346	3444	132	11516
Maine	1513	3119	2009	77	6718
Maryland	4324	8910	5740	220	19194
Massachusetts	9513	19602	12628	484	42227
Michigan	9297	19157	12341	473	41267
Minnesota	5405	11138	7175	275	23993
Mississippi	2378	4901	3157	121	10557
Missouri	4973	10247	6601	253	22073
Montana	1297	2673	1722	66	5758
Nebraska	1730	3564	2296	88	7678
Nevada	649	1337	861	33	2879
New Hampshire	1081	2228	1435	55	4799
New Jersey	4973	10247	6601	253	22073
New Mexico	432	891	574	22	1919
New York	20107	41432	26691	1023	89252
North Carolina	5832	12029	7749	297	25912
North Dakota	865	1782	1148	44	3839
Ohio	7783	16038	10332	396	34549
Oklahoma	2811	5792	3731	143	12476
Oregon	3027	6237	4018	154	13436
Pennsylvania	10810	22275	14350	550	47985
Rhode Island	1081	2228	1435	55	4799
South Carolina	3459	7128	4592	176	15355
South Dakota	649	1337	861	33	2879
Tennessee	3675	7574	4879	187	16315
Texas	9297	19157	12341	473	41267
Utah	865	1782	1148	44	3839
Vermont	865	1782	1148	44	3839
Virginia	5621	11583	7462	286	24952
Washington	4756	9801	6314	242	21113
West Virginia	1730	3564	2296	88	7678
Wisconsin	5405	11138	7175	275	23993
Wyoming	649	1337	861	33	2879
Service Schools	649	1337	861	33	2879
Canal Zone	0	0	0	0	0
Guam	0	0	0	0	0
Puerto Rico	865	1782	1148	44	3839
Virgin Islands	0	0	0	0	0

TABLE IX
ESTIMATED MANPOWER UTILIZATION BY ACADEMIC DEPARTMENTS FOR PROGRAMS IN COMPUTER SCIENCE, DATA PROCESSING, INFORMATION SCIENCE, ETC. 1969-70

Staff Type	Number People	Number FTE
Full time	2,881	2,881
Part-time:		1,731
Research Assts.	977	
Teaching Assts.	1,513	
Other	2,115	
Total	7,486	4,612

Doctorates	Position: Faculty	Other	Total
Computer Science	462	55	517
Other	1,052	137	1,189
Total	1,514	192	1,706

TABLE X
ESTIMATED MANPOWER UTILIZATION BY ACADEMIC DEPARTMENTS FOR PROGRAMS IN COMPUTER SCIENCE, DATA PROCESSING, INFORMATION SCIENCE, ETC. 1973-74

Staff Type	Number People	Number FTE
Full time	3,109	3,109
Part-time:		1,665
Research Assts.	1,118	
Teaching Assts.	1,515	
Other	2,052	
Total	7,794	4,774

Doctorates	Position: Faculty	Other	Total
Computer Science	856	92	948
Other	1,166	123	1,289
Total	2,022	215	2,237

TABLE XI
ESTIMATED MANPOWER UTILIZATION BY ACADEMIC DEPARTMENTS FOR PROGRAMS IN COMPUTER SCIENCE, DATA PROCESSING, INFORMATION SCIENCE, ETC. 1976-77

Staff Type	Number People	Number FTE
Full time	4,770	4,770
Part-time:		3,283
Research Assts.	1,189	
Teaching Assts.	2,528	
Other	3,382	
Total	11,869	8,053

Doctorates	Position: Faculty	Other	Total
Computer Science	1,256	117	1,373
Other	1,894	255	2,149
Total	3,150	372	3,522

TABLE XII
ESTIMATED MANPOWER UTILIZATION BY COMPUTER CENTERS
IN U.S. COLLEGES AND UNIVERSITIES 1969-70

Highest Education Level	Estimated Total	Percent of Total
High School Diploma	9,496	36
Associate Degree	1,360	5
Undergraduate Students	6,928	26
Bachelor's Degree:		
Computer Science	389	1
Other	5,046	19
Master's Degree:		
Computer Science	426	2
Other	2,054	8
Doctorate:		
Computer Science	174	1
Other	829	3
Total	26,704	

Job Classification:	Estimated Total FTE	Percent of Total
Management	3,111	14
Analysts	1,820	8
Systems Programmers	2,131	9
Application Programmers	4,186	18
Operators	8,135	35
Clerical	3,725	16
Total	23,108	

TABLE XIII
ESTIMATED MANPOWER UTILIZATION BY COMPUTER CENTERS
IN U.S. COLLEGES AND UNIVERSITIES 1976-77

Highest Education Level	Estimated Total	Percent of Total
High School Diploma	10,972	35
Associate Degree	2,425	8
Undergraduate Students	5,688	18
Bachelor's Degree:		
Computer Science	1,472	5
Other	6,273	20
Master's Degree		
Computer Science	963	3
Other	2,520	8
Doctorate:		
Computer Science	225	1
Other	1,051	3
Total	31,539	

Job Classification:	Estimated Total FTE	Percent of Total
Management	4,563	15
Analysts	3,196	11
Systems Programmers	2,274	8
Application Programmers	5,549	18
Operators	10,052	33
Clerical	4,444	15
Total	30,078	

Since the modal class for current computer manpower is probably the 35-44 age group with the 25-34 age group running a close second, 3 in 1000 is a good estimate of overall replacement needs due to deaths. However, we need estimates for each of the education levels.

The persons most likely to be replaced by the two-year and four-year graduates are those who have been in the data processing field before computers and are in the "above 45" categories. This plus the fact that there is a tendency to promote from within will cause vacancies due to deaths to open up positions in the lower ranks for people just entering the field. For these reasons, a replacement rate of 5 per 1000 appears logical for the 2-year and 4-year groups. By the same reasoning, a rate of 2 per 1000 appears reasonable for the M.S. and Doctorate categories.

Retirement tends to impact the senior positions, hence, will provide a greater proportion of direct entry positions at the higher education levels. However, because of the promotion from within effect my estimate of replacement needs due to retirement will be uniform for all education levels. For this estimate, we need to know how many of those presently (1972-73) engaged in computer related jobs are age 65. For 1972 (10), there were 42,340,000 persons in the 45-64 age group. Even after allowing for differences due to death rates, there were at least 2,000,000 people who were age 65 in 1973. This is approximately 1.7% of the total population between ages 18-65. The manpower needs due to retirement would then be a rate of 17 per 1000.

For lack of any information to the contrary, I will assume that immigration to the U.S. and to the computer field is balanced by emigration from the computer field and from the U.S.

Computer Manpower Needs for Growth

According to the "Monthly Computer Census" published in Computers and Automation (9), the number of computers installed in the U.S. increased by approximately 60% during 1972 or from 50,000 plus to 80,000 plus. Some of this apparent increase must be due to improved reporting and, of course, the recent influx of mini-computers. Uses of the computers continue to spread. A 10% increase in computer manpower needs at all educational levels seems realistic for the next 5-10 years. Table XIV summarizes the above estimates for computer manpower needs due to replacement and growth.

Table XIV
Future Computer Manpower Needs Per 1000
Estimated 1973 Personnel

	Education Level			
Cause:				
Replacement:	2-year	4-year	M.S.	Doctorate
Deaths	5	5	2	2
Retirements	17	17	17	17
Growth	100	100	100	100
Total Rate	122	122	119	119
Total New Openings	26,376	54,351	34,163	1,309
Estimated 1977 Productions	27,273	9,509	3,161	345

These estimates say that we are producing enough two-year/post-secondary graduates in the computer field, but only one-fourth of the needed doctorates, one-sixth the number of bachelor's and one-eleventh the number of master's levels needed. This reinforces my earlier statement that we are overutilizing undereducated people in the computer related fields. Others may wish to take exception to the assumptions which led to these results. If so, I hope that I have made the procedures transparent enough so that they can produce their own estimates. Even if my estimates are off by 50%, we still would have severe shortages indicated at the 4-year and master's levels for some years. I will admit the possibility of as much as 10% error either direction on the "Estimated 1977 Production" figures and perhaps as much as 20% on the "Total New Openings" estimates. The latter do contain subjective elements. The most debatable element in this regard is the "Estimated Distribution of 1976-77 Computer Staff by Level of Education Required for Replacements" given in Table VI.

Table XV gives need and production estimates for each of the States. The post-secondary vocational institutions' production figures from Table IV are added to the associate degrees to obtain the final "post-secondary and 2-year" estimates. Before adding the reported data given in Table IV, each of the numbers of graduates reported in Table III was multiplied by the reciprocal of the response rate for each state to allow for production by non-reporting institutions.

Comparison with BLS Estimates and Projections for 1980

In the 1978-79 Occupational Outlook Handbook published by the Bureau of Labor Statistics, it was reported that there were over 160,000 systems analysts in 1976, over 230,000 programmers and over 280,000 operators. The projections for 1985 are also presented and are 200,000 for systems analysts, 280,000 for programmers and 340,000 for operators. Some of the differences result from definitions. I would guess that some of what I call systems programmers are counted by BLS as programmers and others as systems analysts since no such category as systems programmers appears in BLS publications referred to above.

Management personnel are most likely to be counted under "Managers" in the BLS classifications and on page 98 of the 1978-79 Handbook there is an indication that what I call other operating personnel (excluding card punch operators) are included under Office Machine Operators. In particular, operators of tabulating machines and related equipment, where such equipment is an integral part of a computer installation, would fall under my classification of "other operating personnel."

In BLS Bulletin 1673, it was estimated that there would be 120,000 computers in use by 1980 and that the number of process computers would reach about 17,000. I believe that the 120,000 figure is conservative, depending upon one's definition of a computer. In the same publication it was estimated that for the period 1968-80 there would be annual openings for 23,000 programmers, 27,000 systems analysts and 20,400 operators, or a total of 70,400 in just these three classifications. Since these three categories account for about two-thirds of my total estimates, extrapolation of the 70,400 figure gives about 105,000 annual openings per year. This number compares very well under the circumstances with my estimated need of 116,000 per year.

TABLE XV
ESTIMATED COMPUTER MANPOWER NEEDS AND ESTIMATED PRODUCTION FOR 1976-77 BY POST-SECONDARY INSTITUTIONS BY STATES

State	PS VOC and 2-year		4-year		Master's		Doctorate	
	Need	Production	Need	Production	Need	Production	Need	Production
Alabama	396	196	815	86	512	17	20	0
Alaska	26	56	54	0	34	0	1	0
Arizona	659	632	1359	163	854	77	33	9
Arkansas	211	42	435	55	273	14	10	0
California	2163	6483	4457	810	2801	464	107	119
Colorado	316	413	652	52	410	34	16	3
Connecticut	369	175	761	45	478	26	18	0
Delaware	79	62	163	0	102	0	4	0
District of Col.	158	53	326	0	205	224	8	0
Florida	607	1193	1250	272	786	24	30	2
Georgia	475	374	978	160	615	124	24	9
Hawaii	106	125	217	0	137	0	5	0
Idaho	79	17	163	26	102	0	4	0
Illinois	1372	1541	2826	678	1176	175	68	58
Indiana	686	428	1413	298	888	114	34	9
Iowa	633	454	1304	255	820	48	31	19
Kansas	448	229	924	187	581	83	22	5
Kentucky	343	133	707	119	444	17	17	0
Louisiana	316	94	652	213	410	3	16	0
Maine	185	15	381	7	239	3	9	0
Maryland	528	1062	1087	323	683	83	26	19
Massachusetts	1161	293	2391	224	1503	103	58	21
Michigan	1134	1370	2337	310	1469	115	56	9
Minnesota	659	153	1359	404	854	120	33	14
Mississippi	290	206	598	162	376	28	14	0
Missouri	607	786	1250	294	786	69	30	7
Montana	158	61	326	17	205	0	8	0
Nebraska	211	114	435	26	273	0	10	0
Nevada	79	55	163	0	102	0	4	0
New Hampshire	132	12	272	29	171	0	7	0
New Jersey	607	677	1250	255	786	124	30	0
New Mexico	53	7	109	14	68	5	3	0
New York	2453	1736	5055	834	3176	267	122	0

TABLE XV (CONT.)
ESTIMATED COMPUTER MANPOWER NEEDS AND ESTIMATED PRODUCTION FOR 1976-77
BY POST-SECONDARY INSTITUTIONS BY STATES

State	PS VOC and 2-year		4-year		Master's		Doctorate	
	Need	Production	Need	Production	Need	Production	Need	Production
North Carolina	712	711	1468	136	922	26	35	3
North Dakota	106	82	217	58	137	2	5	0
Ohio	950	630	1957	710	1230	215	47	14
Oklahoma	343	478	707	19	444	17	17	0
Oregon	369	327	761	65	478	33	18	0
Pennsylvania	1319	895	2718	664	1708	95	65	14
Rhode Island	132	95	272	50	171	24	7	2
South Carolina	422	215	870	14	546	0	21	0
South Dakota	79	36	163	19	102	0	4	0
Tennessee	448	550	924	148	581	5	22	3
Texas	1134	1737	2337	540	1469	138	56	19
Utah	106	32	217	48	137	0	5	0
Vermont	106	0	217	0	137	0	5	0
Virginia	686	499	1413	225	888	64	34	0
Washington	580	455	1196	89	751	33	29	3
West Virginia	211	126	435	79	273	0	10	0
Wisconsin	659	1045	1359	239	854	144	33	9
Wyoming	79	58	163	17	102	0	4	0
Service Schools	79	0	163	36	102	0	4	0
Canal Zone	0	0	0	0	0	0	0	0
Guam	0	0	0	0	0	0	0	0
Puerto Rico	106	55	217	21	137	0	5	0
Virgin Islands	0	0	0	0	0	0	0	0
American Samoa	0	0	0	0	0	0	0	0

OPTIMUM SIZE FOR DEGREE PROGRAMS

The optimum size for a degree program in terms of number of students enrolled and annual number of graduates depends upon several factors, such as number of students served from other disciplines, combinations of different levels of degree programs, research activity, etc. My objective here is to establish minimum enrollment and annual graduates in order to obtain estimates of production by existing programs if they were to function at these minimum levels. A State or Region may then judge whether the emphasis should be placed upon strengthening existing programs, establishing new programs or both. In addition to staff costs for programs, the cost of providing adequate and appropriate laboratory equipment for the program should also be considered. Is it worthwhile to provide a computer installation costing forty thousand per year for a laboratory in a post-secondary vocational or 2-year program for twenty students? Is $100 per year per student a reasonable figure for laboratory costs for data processing and computer science majors? In view of the President's Science Advisory Committee's (17) recommendation of $60 per year per student overall for computer costs, $100 seems a little low for majors, particularly at the upper levels. For the following discussions, let's assume the following costs are reasonable:

	Cost/Student/Year
Post Secondary Vocational	$100
2-year	$100
4-year	$200
M.S.	$500
Doctorate	$1000

Post Secondary Vocational and 2-Year Programs

The post secondary vocational and 2-year programs are usually offered in isolation from each other and the higher level programs. Unless the computer facilities can be shared for administrative functions or other similar programs in other institutions, the minimum adequate computer installation costs of approximately $40,000 per year requires that there be a total enrollment of about 400 students to come close to the $100 per student per year figure. Allowing 40 (10%) for students in other majors taking courses in data processing, computer technology, etc., this leaves 360 as the minimum number of majors. Assuming that approximately one-third of these complete the program each year, gives 120 graduates per program per year. If all of the estimated 570 2-year programs going in 1976-77 produced at this (120) level, we would be producing 68,000 graduates per year in the 2-year programs alone. In (6) I estimated that approximately half of the 2-year programs in 1969-70 were weak in some respect. If these were discontinued and the remaining ones strengthened, we would still be producing 34,000 graduates per year in the 2-year programs alone in addition to the post-secondary vocational programs. As I see it, it is imperative that the two-year programs be examined carefully, the weak ones eliminated, the others strengthened and that close contact and cooperation be maintained with the 4-year programs in order that approximately half of the 2-year graduates can move into the 4-year programs with minimal loss of credits. The problems associated with transfer credits from the post-secondary vocational school to colleges and universities are more complex. Nevertheless, the same contact and cooperation with colleges and universities should be established and maintained wherever possible. If something is not done soon, we can expect to have a glut in the market for post secondary vocational and 2-year graduates during the next 5 to 10 years. During the period from 1970 thru 1974 it appeared that something had been accomplished in this direction. However 1976-77 data indicates that the problem is with us once more.

Four-Year Programs

Four-year programs grew from ninety (90) in 1966-67 to 276 in 1971-72 with graduates increasing from an average of 7 per program in 1966-67 to 14 per program in 1970-71, 19 per program in 1974-75, and 18 per program in 1976-77 (see Tables I and II). Growth for the four-year programs has been slow because no federal programs have been aimed directly at implementing these programs as has been done for the post-secondary vocational and 2-year programs. Another reason for the slowness of growth has been due to a lack of qualified staff (i.e., holders of advanced degrees) to staff the programs. This situation is changing rapidly. There are many faculty now on the market who have doctorates in other areas, (Math, Physics, etc.) who are finding it more and more difficult to join a computer science department offering graduate programs but are well qualified to participate in stand-alone B.S. degree programs.

In Table XIV my estimates show that we have a national potential annual need for about 45,000 more B.S. graduates in computer science, data processing, and related areas. Programs producing nearly 100 graduates per year (enrollment of approximately 400 students) appears to me to be optimal. (Obviously the small four year colleges will not be able to attain programs of this magnitude.) This would mean that 560 programs would be needed. With an estimated 541 programs in 1976-77 and many of these still lacking in some manner, there is still need for considerable activity at the 4-year level.

The institutions involved and wanting to get involved in bachelor's level programs in computer science, data processing, etc., should study state and regional needs, strengthen, broaden and expand existing 4-year programs, delete other weak programs and initiate programs where state and regional need is indicated.

Master's Programs

Master's degree programs grew in number from 98 in 1966-67 to 190 in 1971-72. Graduates increased from less than 8 per program in 1966-67 to 11 per program in 1970-71, 19 per program in 1974-75 and down to 14 per program in 1976-77 (see Tables I and II). The optimum size for a master's degree program is one which produces about 50 graduates per year and averaging an enrollment of more than 100. This implies the need for about 618 programs at the Master's level or about three times the existing number (224 for 1976-77). This kind of growth at the graduate level is not in sight, unfortunately. With new monies for higher education so few, such expansion must come from a reallocation of existing resources by trimming the budgets of programs with decreasing enrollments. This is a slow and painful process for university administrators. Those "who have" are in a better position "to get and keep". With diminishing enrollments, teaching loads are lighter and time is available for a flurry of activity to keep what they have. A growing department (or one which has potential for growth) is burdened with teaching and activities associated with large numbers of majors and cannot compete on the same basis. The end result is "those who have — keep" and there is nothing available for "those who need". Only the boldest and bravest administrators can counter this situation.

My recommendations for institutions offering or wanting to offer master's level programs in computer science, information systems, etc., is still the same. Study state and regional needs and then full speed ahead.

Doctorate Level Programs

If we assume that a doctorate requires on the average of three years beyond the master's and that one-third of those who start drop out after three years or less, then doctorate programs with about 45 students enrolled would graduate about 10 per year. Although this is a little high for average production, it appears to be optimal to support the kind of master's and bachelor's programs I have stated as being optimal above. If the existing (1978-79) 126 programs were producing at this level in the years ahead (5-10) we would be producing about the number estimated to be needed. Unfortunately they are averaging less than three per year. State and Regional studies should be made on production vs need and indicated action taken.

SUMMARY

Large numbers of personnel have been able to enter the computer manpower pool in the past with little training. The proprietary schools had a "heyday". Only the best and largest have survived. Large amounts of federal and state funds were poured into the vocational and 2-year programs. I question the value of those operated at the secondary level and have indicated that there should be a weeding out of the weakest post-secondary vocational and 2-year programs. On the other hand, computer education at the secondary level should not be neglected. Secondary schools should provide enough computer education so that the student can learn to live comfortably in a computer assisted environment and also enough so that students pursuing post-secondary education can judge whether or not they wish to pursue a program of study which will prepare them for entry into the computer manpower pool.

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APPENDIX A
INSTITUTIONS REPORTING THE OFFERING OF DEGREE PROGRAMS

The degree program names and department names were coded as follows by the institutions' respondents.

Degree Program Name	Code
Computer Engineering	CEN
Computer Programming	CPR
Computer Science	CSC
Computer Science and Engineering	CSE
Computer Science Technology	CST
Computer Technology	CTE
Data Processing	DPR
Electronic Data Processing	EDP
Information and Computer Sciences	ICS
Information Processing	IPR
Information Science	ISC
Information Systems	ISY
Systems Analysis	SAN
Systems Engineering	SEN
Systems and Information Sciences	SIS
System Sciences	SYS
Unknown or not elsewhere classified	OTH

Department Name	Code
Business Administration	BAD
Computer and Communications Sciences	CCS
Computer and Information Science	CIS
Computer Programming	CPR
Computer Science	CSC
Computer Technology	CTE
Data Processing	DPR
Electrical Engineering	EEN
Electrical Engineering Technology	EET
Industrial Engineering	IEN
Information and Computer Science	ICS
Information Processing	IPR
Information Science	ISC
Information Systems	ISY
Mathematics	MAT
Systems Analysis	SAN
Statistics and Computer Science	SCS
Systems Engineering	SEN
Systems and Information Sciences	SIS
Systems Science	SYS
More than one of the above:	
Committee	COM
Other Departments in	
Engineering	ENG
Environmental Sciences	ENV
Life Sciences	LSC
Mathematical Sciences	MSC
Physical Sciences	PSC
Social Sciences	SSC
Education	EDU
Business, Commerce	BUS
Other Departments not elsewhere classified	NEC

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GROUP (;ASSOCIATE;) DEGREE PROGRAMS

(AS OF JUNE 30, 1977)

YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
BAD PROGRAM IN DEPT OF BAD								
A	A	A	GAINESVILLE JR COLLEGE	GAINESVILLE	GA	30501	0	0
CPR PROGRAM IN DEPT OF BAD								
A	A	A	SHASTA COLLEGE	REDDING	CA	96001	0	0
A	A	A	DURHAM COLLEGE	DURHAM	NC	27707	70	0
	A	A	METROPOLITAN TECHNICAL CC	OMAHA	NE	68137	25	0
A	A	A	GENESEE COMMUNITY COLLEGE	BATAVIA	NY	14020	40	0
A	A	A	CINCINNATI TECH COLLEGE	CINCINNATI	OH	45223	80	0
CPR PROGRAM IN DEPT OF BUS								
A	A	A	BREVARD CMTY COLLEGE	COCOA	FL	32922	206	0
A	A	A	KANKAKEE CMTY COLLEGE	KANKAKEE	IL	60901	15	0
A	A	A	BERGEN COMMUNITY COLLEGE	PARAMUS	NJ	07652	313	0
A	A	A	TERRA TECHNICAL COLLEGE	FREMONT	OH	43420	65	0
A	A	A	MICHAEL J OWENS TECH C	TOLEDO	OH	43699	135	0
CPR PROGRAM IN DEPT OF CIS								
A	A	A	SIERRA COLLEGE	ROCKLIN	CA	95677	50	0
CPR PROGRAM IN DEPT OF CPR								
A	A	A	IND VOC TECH C-KOKOMO	KOKOMO	IN	46901	29	0
A	A	A	IND VOC TECH C-SOUTH BEND	SOUTH BEND	IN	46619	80	0
A	A	A	BRISTOL COMMUNITY COLLEGE	FALL RIVER	MA	02720	12	0
A	A	A	DAVENPORT COLLEGE OF BUS	GRAND RAPIDS	MI	49502	153	0
A	A	A	NORTHLAND CMTY COLLEGE	THF RIVR FLS	MN	56701	5	0
A	A	A	STARK TECHNICAL COLLEGE	CANTON	OH	44720	148	0
A	A	A	TRIDENT TECH C-NORTH CAM	CHARLESTON	SC	29411	60	0
CPR PROGRAM IN DEPT OF CSC								
A	A		POTOMAC STATE COLLEGE	KEYSER	WV	26726	55	0
CPR PROGRAM IN DEPT OF DPR								
A	A	A	TALLAHASSEE CMTY COLLEGE	TALLAHASSEE	FL	32304	13	0
A	A	A	MANATEE JUNIOR COLLEGE	BRADENTON	FL	33507	100	0
A	A	A	WESTERN IOWA TECH COMM CO	SIOUX CITY	IA	51102	50	0
A	A	A	KIRKWOOD CMTY COLLEGE	CEDAR RAPIDS	IA	52406	150	0
A	A	A	LAKE COUNTY, COLLEGE OF	GRAYSLAKE	IL	60030	350	0
A	A	A	CARL SANDBURG COLLEGE	GALESBURG	IL	61401	14	0
A	A	A	GUILFORD TECHNICAL INST	JAMESTOWN	NC	27282	110	0
A	A	A	ND STATE SCHOOL SCIENCE	WAHPETON	ND	58075	65	0
A	A	A	SAN ANTONIO COLLEGE	SAN ANTONIO	TX	78284	999	0
A	A	A	TEX ST TECH RIO GRANDE	HARLINGEN	TX	78550	30	0
A	A	A	NORTHEAST WIS TECH INST	GREEN BAY	WI	54303	119	0
CPR PROGRAM IN DEPT OF ISY								
A	A	A	PRAIRIE STATE COLLEGE	CHICAGO HTS	IL	60411	125	0
CPR PROGRAM IN DEPT OF MAT								
A	A	A	VALLEY FORGE MILITARY JC	WAYNE	PA	19087	0	0
CSC PROGRAM IN DEPT OF BAD								
A	A	A	PALOMAR COLLEGE	SAN MARCOS	CA	92069	30	0
A	A	A	ABRAHAM BALDWIN AGRL C	TIFTON	GA	31794	30	0
A	A	A	HOCKING TECHNICAL COLLEGE	NELSONVILLE	OH	45764	55	0
CSC PROGRAM IN DEPT OF BUS								
A	A	A	MAINLAND, COLLEGE OF THE	TEXAS CITY	TX	77590	47	0
CSC PROGRAM IN DEPT OF CIS								
A	A	A	MERCED COLLEGE	MERCED	CA	95340	0	0
CSC PROGRAM IN DEPT OF COM								
A	A	A	ATLANTA JUNIOR COLLEGE	ATLANTA	GA	30310	27	0
A	A	A	WILLIAMSPORT AREA CC	WILLIAMSPORT	PA	17701	300	0
CSC PROGRAM IN DEPT OF CSC								
A	A	A	PIMA COMMUNITY COLLEGE	TUCSON	AZ	85709	200	0
A	A	A	DIABLO VALLEY COLLEGE	PLEASANT HILL	CA	94523	50	0
A	A	A	SANTA BARBARA CTY COLLEGE	SANTA BARBARA	CA	93109	200	0
A	A	A	SANTA ANA COLLEGE	SANTA ANA	CA	92706	95	0
A	A	A	UNION CO TECHNICAL INST	SCOTCH PLAINS	NJ	07076	75	0
A	A	A	OCEAN COUNTY COLLEGE	TOMS RIVER	NJ	08753	125	0
A	A	A	JAMESTOWN CMTY COLLEGE	JAMESTOWN	NY	14701	0	0
A	A	A	NEW KENSINGTON CAMPUS - P	NEW KENSINGTN	PA	15068	31	0
A	A	A	BEAVER CAMPUS - PSU	MONACA	PA	15061	53	0
A	A	A	SCHUYLKILL CAMPUS PSU	SHYLKL HAVEN	PA	17972	28	0
A	A	A	WORTHINGTON-SCRANTON CAMP	DUNMORE	PA	18512	31	0
A	A	A	SAN JACINTO COLLEGE	PASADENA	TX	77505	270	0
A	A	A	TEMPLE JUNIOR COLLEGE	TEMPLE	TX	76501	180	0
		A	NATIONAL BUSINESS COLLEGE	ROANOKE	VA	24009	15	0
A	A	A	COLUMBIA BASIN CC	PASCO	WA	99301	40	0
A	A	A	NORTHWEST CMTY COLLEGE	POWELL	WY	82435	5	0
CSC PROGRAM IN DEPT OF CTE								
A	A	A	KANSAS TECHNICAL INST	SALINA	KS	67401	30	0

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DEGREE PROGRAMS

GROUP I (ASSOCIATE) CONTINUED

(AS OF JUNE 30, 1977)

YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
CSC PROGRAM IN DEPT OF DPR								
A	A	A	CHATTAHOOCHEE VALLEY CC	PHENIX CITY	AL	36867	7	0
A	A	A	LURLEEN B WALLACE ST JC	ANDALUSIA	AL	36420	10	0
A	A	A	GULF COAST CMTY COLLEGE	PANAMA CITY	FL	32401	84	0
A	A	A	HUDSON VLY CMTY COLLEGE	TROY	NY	12180	100	0
CSC PROGRAM IN DEPT OF MAT								
A	A	A	MARIN, COLLEGE OF	KENTFIELD	CA	94904	0	0
A	A	A	MONTGOMERY C TAKOMA PARK	TAKOMA PARK	MD	20012	31	0
A	A	A	MOUNT HOOD CMTY COLLEGE	GRESHAM	OR	97030	7	0
CSC PROGRAM IN DEPT OF MSC								
A	A	A	BRUNSWICK JUNIOR COLLEGE	BRUNSWICK	GA	31520	4	0
CSC PROGRAM IN DEPT OF NEC								
A	A	A	RHODE ISLAND JR COLLEGE	WARWICK	RI	02886	45	0
CSE PROGRAM IN DEPT OF CSE								
A	A	A	PITTSBG BRADFORD CAM, U O	BRADFORD	PA	16701	15	0
CST PROGRAM IN DEPT OF CCS								
A	A	A	NTHESTN OKLA AGRL-MECH C	MIAMI	OK	74354	67	0
CST PROGRAM IN DEPT OF CSC								
A	A	A	WENTWORTH INSTITUTE	BOSTON	MA	02115	30	0
A	A	A	MOTLOW STATE CMTY COLLEGE	TULLAHOMA	TN	37388	33	0
A	A	A	ALVIN COMMUNITY COLLEGE	ALVIN	TX	77511	10	0
CST PROGRAM IN DEPT OF EET								
A	A	A	MILWAUKEE AREA TECH C	MILWAUKEE	WI	53203	85	0
CTE PROGRAM IN DEPT OF CSC								
A	A	A	MOUNT SAN ANTONIO COLLEGE	WALNUT	CA	91789	40	0
A	A	A	BUCKS COUNTY COMMUNITY CO	NEWTOWN	PA	18940	88	0
CTE PROGRAM IN DEPT OF CTE								
A	A	A	FLORIDA KEYS COMMUNITY CO	KEY WEST	FL	33040	26	0
A	A	A	IND VOC TECH C CEN OFF	INDIANAPOLIS	IN	46206	602	0
A	A	A	HOLYOKE COMMUNITY COLLEGE	HOLYOKE	MA	01040	78	0
A	A	A	ITAWAMBA JUNIOR COLLEGE	FULTON	MS	38843	30	0
A	A	A	KENT STATE U., TRUMBULL C	WARREN	OH	44483	79	0
DPR PROGRAM IN DEPT OF BAD								
A	A	A	MESA COMMUNITY COLLEGE	MESA	AZ	85202	168	0
A	A	A	GLENDALE CMTY COLLEGE	GLENDALE	AZ	85302	180	0
A	A	A	MARICOPA TECH CC	PHOENIX	AZ	85004	230	0
A	A	A	SCOTTSDALE CMTY COLLEGE	SCOTTSDALE	AZ	85252	15	0
A	A	A	PHOENIX COLLEGE	PHOENIX	AZ	85013	187	0
A	A	A	LONG BEACH CITY COLLEGE	LONG BEACH	CA	90808	174	0
A	A	A	GREATER HARTFORD CC	HARTFORD	CT	06105	120	0
A	A	A	OKALOOSA-WALTON JUNIOR C	NICEVILLE	FL	32578	164	0
A	A	A	MIDDLE GEORGIA COLLEGE	COCHRAN	GA	31014	19	0
	A	A	IOWA CENTRAL CC	FORT DODGE	IA	50501	0	0
A	A	A	ROCK VALLEY COLLEGE	ROCKFORD	IL	61101	175	0
A	A	A	HIGHLAND CMTY COLLEGE	FREEPORT	IL	61032	113	0
A	A	A	NEWBURY JUNIOR COLLEGE	BOSTON	MA	02115	24	0
A	A	A	CAPE COD CMTY COLLEGE	W BARNSTABLE	MA	02668	29	0
A	A	A	NORTH SHORE CMTY COLLEGE	BEVERLY	MA	01915	50	0
A	A	A	WAYNE COUNTY CMTY COLLEGE	DETROIT	MI	48201	253	0
A	A	A	MUSKEGON BUSINESS COLLEGE	MUSKEGON	MI	49442	70	0
A	A	A	LONGVIEW COMMUNITY COLLEG	LEE'S SUMMIT	MO	64063	147	0
A	A	A	BURLINGTON COUNTY COLLEGE	PEMBERTON	NJ	08068	134	0
A	A	A	CAYUGA CO CMTY COLLEGE	AUBURN	NY	13021	32	0
A	A	A	CORNING COMMUNITY COLLEGE	CORNING	NY	14830	55	0
A	A	A	SHAWNEE ST GEN AND TECH C	PORTSMOUTH	OH	45662	22	0
A	A	A	CLATSOP COMMUNITY COLLEGE	ASTORIA	OR	97103	10	0
A	A	A	BEAVER CO, CMTY COLLEGE O	MONACA	PA	15061	43	0
A	A	A	FLORENCE DARLINGTON TECH	FLORENCE	SC	29502	36	0
A	A	A	STATE TECH INST MEMPHIS	MEMPHIS	TN	38134	289	0
A	A	A	EL CENTRO COLLEGE	DALLAS	TX	75202	247	0
A	A	A	GRAYSON CO JUNIOR COLLEGE	DENISON	TX	75020	50	0
A	A	A	MILWAUKEE AREA TECH C	MILWAUKEE	WI	53203	650	0
DPR PROGRAM IN DEPT OF BUS								
A	A	A	DENVER CENTRAL OFF, CC OF	DENVER	CO	80203	300	0
A	A	A	THORNTON CMTY COLLEGE	SOUTH HOLLAND	IL	60473	84	0
A	A	A	MCHENRY COUNTY COLLEGE	CRYSTAL LAKE	IL	60014	10	0
A	A	A	HOWARD COMMUNITY COLLEGE	COLUMBIA	MD	21044	92	0
A	A	A	MONROE CO CMTY COLLEGE	MONROE	MI	48161	50	0
A	A	A	MINN TECH INST CROOKSTN,	CROOKSTON	MN	56716	16	0
A	A	A	DUTCHESS CMTY COLLEGE	POUGHKEEPSIE	NY	12601	65	0
A	A	A	MUSKINGUM AREA TECH C	ZANESVILLE	OH	43701	42	0

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GROUP I :ASSOCIATE: DEGREE PROGRAMS) CONTINUED
(AS OF JUNE 30, 1977)

YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
A	A	A	CLARK TECHNICAL COLLEGE	SPRINGFIELD	OH	45505	79	0
A	A	A	MARION TECHNICAL COLLEGE	MARION	OH	43302	40	0
A	A	A	STHWSTN OREG CMTY COLLEGE	COOS BAY	OR	97420	22	0
DPR PROGRAM IN DEPT OF CIS								
A	A	A	SCHOOLCRAFT COLLEGE	LIVONIA	MI	48151	130	0
		A	VOLUNTEER ST CMTY COLLEGE	GALLATIN	TN	37066	20	0
DPR PROGRAM IN DEPT OF COM								
A	A	A	BARTON CO CMTY JR COLLEGE	GREAT BEND	KS	67530	57	0
DPR PROGRAM IN DEPT OF CPR								
A	A	A	NORTH CENTRAL TECH INST	WAUSAU	WI	54401	70	0
DPR PROGRAM IN DEPT OF CSC								
A	A	A	JEFFERSON ST JR COLLEGE	BIRMINGHAM	AL	35215	200	0
A	A	A	SAN JOAQUIN DELTA COLLEGE	STOCKTON	CA	95207	200	0
A	A	A	MOUNT SAN ANTONIO COLLEGE	WALNUT	CA	91789	200	0
A	A	A	MASSASOIT CMTY COLLEGE	BROCKTON	MA	02402	35	0
A	A	A	OAKLAND COMMUNITY COLLEGE	BLOOMFLD HLS	MI	48013	400	0
A	A	A	BUCKS COUNTY COMMUNITY CO	NEWTOWN	PA	18940	106	0
DPR PROGRAM IN DEPT OF CTE								
A	A	A	ULSTER CO CMTY COLLEGE	STONE RIDGE	NY	12484	45	0
DPR PROGRAM IN DEPT OF DPR								
A	A	A	NTHEST ALA ST JR COLLEGE	RAINSVILLE	AL	35986	15	0
A	A	A	YAVAPAI COLLEGE	PRESCOTT	AZ	86301	12	0
A	A	A	MONTEREY PEN COLLEGE	MONTEREY	CA	93940	40	0
A	A	A	CONTRA COSTA COLLEGE	SAN PABLO	CA	94806	150	0
A	A	A	SISKIYOUS, COLLEGE OF THE	WEED	CA	96094	0	0
A	A	A	AMERICAN RIVER COLLEGE	SACRAMENTO	CA	95841	200	0
A	A	A	WEST VALLEY COLLEGE	SARATOGA	CA	95070	45	0
A	A	A	SANTA ANA COLLEGE	SANTA ANA	CA	92706	75	0
A	A	A	CHAFFEY COLLEGE	ALTA LOMA	CA	91701	300	0
A	A	A	CHABOT COLLEGE	HAYWARD	CA	94545	125	0
A	A	A	EL PASO COMMUNITY COLLEGE	COLORADO SPG	CO	80904	238	0
A	A	A	TRINIDAD STATE JR COLLEGE	TRINIDAD	CO	81082	14	0
A	A	A	OTERO JUNIOR COLLEGE	LA JUNTA	CO	81050	25	0
A	A	A	THAMES VLY STATE TECH C	NORWICH	CT	06360	200	0
A	A	A	MANCHESTER CMTY COLLEGE	MANCHESTER	CT	06040	140	0
A	A	A	DELA. TECH. & COM. COLLEG	GEORGETOWN	DE	19947	52	2
A	A	A	BROWARD CMTY COLLEGE	FT LAUDERDALE	FL	33301	135	0
A	A	A	MIAMI-DADE CMTY COLLEGE	MIAMI	FL	33176	400	0
A	A	A	POLK COMMUNITY COLLEGE	WINTER HAVEN	FL	33880	45	0
A	A	A	SNT JOHNS RIVER JUNIOR C	PALATKA	FL	32077	15	0
A	A	A	EDISON COMMUNITY COLLEGE	FORT MYERS	FL	33901	25	0
A	A	A	DAYTONA BCH CMTY COLLEGE	DAYTONA BEACH	FL	32015	103	0
A	A	A	CHIPOLA JUNIOR COLLEGE	MARIANNA	FL	32446	17	0
A	A	A	BRUNSWICK JUNIOR COLLEGE	BRUNSWICK	GA	31520	81	0
A	A	A	HAWAII KAPIOLANI CC,U OF	HONOLULU	HI	96814	190	0
A	A	A	IOWA WSTN CC COUNCIL BLF	COUNCIL BLF	IA	51501	45	0
A	A	A	LEWIS AND CLARK CC	GODFREY	IL	62035	50	0
A	A	A	DUPAGE, COLLEGE OF	GLEN ELLYN	IL	60137	316	0
A	A	A	WAUBONSEE CMTY COLLEGE	SUGAR GROVE	IL	60554	324	0
A	A	A	SAUK VALLEY COLLEGE	DIXON	IL	61021	32	0
A	A	A	JOLIET JUNIOR COLLEGE	JOLIET	IL	60436	140	0
A	A	A	JOHNSN CO CMTY JR COLLEGE	OVERLAND PARK	KS	66210	380	0
A	A	A	SEWARD CO CMTY JR COLLEGE	LIBERAL	KS	67901	20	0
A	A	A	COWLEY CO CMTY JR COLLEGE	ARKANSAS CITY	KS	67005	15	0
A	A	A	KANSAS CITY KANS CMTY JC	KANSAS CITY	KS	66112	120	0
A	A	A	MT WACHUSETT CMTY COLLEGE	GARDNER	MA	01440	47	0
A	A	A	HARFORD COMMUNITY COLLEGE	BEL AIR	MD	21014	113	0
A	A	A	ALLEGHNY CMTY COLLEGE	CUMBERLAND	MD	21502	50	0
A	A	A	ANNE ARUNDEL CMTY COLLEGE	ARNOLD	MD	21012	396	0
A	A	A	HAGERSTOWN JUNIOR COLLEGE	HAGERSTOWN	MD	21740	59	0
A	A	A	BEAL BUSINESS COLLEGE	BANGOR	ME	04401	49	0
A	A	A	GOGEBIC COMMUNITY COLLEGE	IRONWOOD	MI	49938	22	0
A	A	A	SUOMI COLLEGE	HANCOCK	MI	49930	21	0
A	A	A	MACOMB CO CC CEN OFFICE	WARREN	MI	48093	300	0
A	A	A	SNT CLAIR CO CMTY COLLEGE	PORT HURON	MI	48060	95	0
A	A	A	WASHTENAW CMTY COLLEGE	ANN ARBOR	MI	48106	260	0
A	A	A	NORTHWESTERN MICH COLLEGE	TRAVERSE CITY	MI	49684	26	0
A	A	A	WEST SHORE CMTY COLLEGE	SCOTTVILLE	MI	49454	9	0
A	A	A	PENN VALLEY CMTY COLLEGE	KANSAS CITY	MO	64111	75	0
A	A	A	SNT LU CC-FLORISSANT VLY	SAINT LOUIS	MO	63135	236	0
A	A	A	SAINT LOUIS CC-MERAMEC	KIRKWOOD	MO	63122	175	0
A	A	A	SNT LU CC-FOREST PARK	SAINT LOUIS	MO	63110	200	0
A	A	A	MOBERLY JUNIOR COLLEGE	MOBERLY	MO	65270	2	0
A	A	A	JONES CO JUNIOR COLLEGE	ELLISVILLE	MS	39437	69	0
A	A	A	SOUTHWEST MISS JR COLLEGE	SUMMIT	MS	39666	20	0
A	A	A	MISS GULF CST JC CEN OFF	PERKINSTON	MS	39573	43	0
A	A	A	COPIAH-LINCOLN JR COLLEGE	WESSON	MS	39191	27	0

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GROUP (:ASSOCIATE:) CONTINUED

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YEAR OFFERED AND DEGREE							MAJORS ENROLLED 1976-77	
1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	UNDERGRAD	GRADUATE
A	A	A	PEARL RIVER JR COLLEGE	POPLARVILLE	MS	39470	40	0
A	A	A	WAKE TECHNICAL INSTITUTE	RALEIGH	NC	27603	56	0
A	A	A	DAVIDSON CO CMTY COLLEGE	LEXINGTON	NC	27292	20	0
A	A	A	RICHMOND TECHNICAL INST	HAMLET	NC	28345	26	0
A	A	A	FORSYTH TECHNICAL INST	WINSTON-SALEM	NC	27103	96	0
A	A	A	ASHEVL BUNCOMBE TECH INST	ASHEVILLE	NC	28801	71	0
A	A	A	SOUTHEAST CC MILFORD CAM	MILFORD	NE	68405	53	0
	A	A	PASSAIC CO CMTY COLLEGE	PATERSON	NJ	07509	0	0
A	A	A	CUNY BRONX CMTY COLLEGE	BRONX	NY	10453	0	0
A	A	A	JEFFERSON CMTY COLLEGE	WATERTOWN	NY	13601	27	0
A	A	A	SUNY AGRL & TECH C CANTON	CANTON	NY	13617	67	0
A	A	A	SUFFOLK CO CMTY COLLEGE	SELDEN	NY	11784	0	0
A	A	A	NIAGARA CO CMTY COLLEGE	SANBORN	NY	14132	90	0
A	A	A	SUNY AGRL TECH C COBLESKL	COBLESKILL	NY	12043	100	0
A	A	A	CUNY BORO OF MANHATTAN CC	NEW YORK	NY	10019	522	0
A	A	A	MONROE COMMUNITY COLLEGE	ROCHESTER	NY	14623	200	0
A	A	A	SINCLAIR CMTY COLLEGE	DAYTON	OH	45402	420	0
A	A	A	CUYAHOGA CC WESTERN CAM	PARMA HTS	OH	44130	100	0
A	A	A	NORTHERN OKLAHOMA COLLEGE	TONKAWA	OK	74653	25	0
A	A	A	LANE COMMUNITY COLLEGE	EUGENE	OR	97405	75	0
A	A	A	CHEMEKETA CMTY COLLEGE	SALEM	OR	97303	60	0
A	A	A	NORTHAMPTON CO AREA CC	BETHLEHEM	PA	18017	170	0
A	A	A	PHILADELPHIA, CMTY COLLEG	PHILADELPHIA	PA	19107	90	0
A	A	A	CLEVELAND ST CMTY COLLEGE	CLEVELAND	TN	37311	36	0
A	A	A	TEXAS SOUTHMOST COLLEGE	BROWNSVILLE	TX	78520	50	0
A	A	A	CISCO JUNIOR COLLEGE	CISCO	TX	76437	40	0
A	A	A	KILGORE COLLEGE	KILGORE	TX	75662	75	0
A	A	A	DEL MAR COLLEGE	CORPUS CHRSTI	TX	78404	55	0
A	A	A	MCLENNAN CMTY COLLEGE	WACO	TX	76708	1[illegible]	0
A	A	A	WHARTON CO JR COLLEGE	WHARTON	TX	77488	292	0
A	A	A	PARIS JUNIOR COLLEGE	PARIS	TX	75460	61	0
A	A	A	NAVARRO COLLEGE	CORSICANA	TX	75110	12	0
A	A	A	J SARGEANT REYNOLDS CC	RICHMOND	VA	23241	481	0
A	A	A	DANVILLE CMTY COLLEGE	DANVILLE	VA	24541	65	0
A	A	A	CENTRAL VA CMTY COLLEGE	LYNCHBURG	VA	24502	72	0
A	A	A	VA WESTERN CMTY COLLEGE	ROANOKE	VA	24015	138	0
A	A	A	TIDEWATER CMTY COLLEGE	PORTSMOUTH	VA	23703	477	0
A	A	A	THOMAS NELSN CMTY COLLEGE	HAMPTON	VA	23670	214	0
A	A	A	NORTHERN VA CMTY COLLEGE	ANNANDALE	VA	22003	122	0
A	A	A	BIG BEND CMTY COLLEGE	MOSES LAKE	WA	98837	40	0
A	A	A	SEATTLE CC CENTRAL CAMPUS	SEATTLE	WA	98122	40	0
	A	A	YAKIMA VALLEY COLLEGE	YAKIMA	WA	98907	0	0
A	A	A	WESTERN WIS TECH INST	LA CROSSE	WI	54601	43	0
A	A	A	FOX VALLEY TECH INST	APPLETON	WI	54911	150	0
A	A	A	MADISON AREA TECH COLLEGE	MADISON	WI	53703	320	0
A	A	A	DISTRICT ONE TECH INST	EAU CLAIRE	WI	54701	100	0
A	A	A	WEST VIRGINIA NORTHERN CC	WHEELING	WV	26003	26	0
A	A	A	WESTERN WYO CMTY COLLEGE	ROCK SPRINGS	WY	82901	26	0
DPR PROGRAM IN DEPT OF ISY								
A	A	A	CITRUS COLLEGE	AZUSA	CA	91702	135	0
DPR PROGRAM IN DEPT OF MAT								
A	A	A	SUFFOLK CO CMTY COLLEGE	SELDEN	NY	11784	0	0
DPR PROGRAM IN DEPT OF NEC								
A	A	A	ESSEX COMMUNITY COLLEGE	BALT COUNTY	MD	21237	354	0
A	A	A	LANSING COMMUNITY COLLEGE	LANSING	MI	48901	195	0
A	A	A	WESTCHESTER CMTY COLLEGE	VALHALLA	NY	10595	55	0
DPR PROGRAM IN DEPT OF SYS								
A	A	A	CHAS S MOTT CMTY COLLEGE	FLINT	MI	48503	0	0
EDP PROGRAM IN DEPT OF DPR								
A	A	A	ODESSA COLLEGE	ODESSA	TX	79760	15	0
ICS PROGRAM IN DEPT OF CIS								
A	A	A	LOS ANG VALLEY COLLEGE	VAN NUYS	CA	91401	36	0
IPR PROGRAM IN DEPT OF IPR								
A	A	A	ESSEX COUNTY COLLEGE	NEWARK	NJ	07102	245	0
ISY PROGRAM IN DEPT OF ISY								
A	A	A	ORANGE COAST COLLEGE	COSTA MESA	CA	92626	358	0
OTH PROGRAM IN DEPT OF BAD								
A	A	A	CENTRAL ARIZONA COLLEGE	COOLIDGE	AZ	85228	21	0
A	A	A	JOHN A LOGAN COLLEGE	CARTERVILLE	IL	62918	0	0
A	A	A	LONGVIEW COMMUNITY COLLEG	LEE'S SUMMIT	MO	64063	65	0
A	A	A	FINGER LAKES,CMTY COLLEGE	CANANDAIGUA	NY	14424	140	0
OTH PROGRAM IN DEPT OF CTE								
A	A	A	COLUMBIA ST CMTY COLLEGE	COLUMBIA	TN	38401	49	0

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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
OTH PROGRAM IN DEPT OF DPR								
A	A	A	IOWA WESTERN CC CEN OFF	COUNCIL BLF	IA	51501	50	0
A	A	A	LEHIGH CO CMTY COLLEGE	SCHNECKSVILLE	PA	18078	64	0
A	A	A	NORTH SEATTLE CC	SEATTLE	WA	98103	125	0
OTH PROGRAM IN DEPT OF EET								
A	A	A	SUFFOLK CO CMTY COLLEGE	SELDEN	NY	11784	0	0
OTH PROGRAM IN DEPT OF MAT								
A	A	A	LONG BEACH CITY COLLEGE	LONG BEACH	CA	90808	0	0
OTH PROGRAM IN DEPT OF NEC								
A	A	A	MONTGOMERY CO COMMUNITY C	BLUE BELL	PA	19422	198	0

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GROUP I (BACHELORS) DEGREE PROGRAMS
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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
CPR PROGRAM IN DEPT OF BAD								
A	A	A	PERU STATE COLLEGE	PERU	NE	68421	4	0
CPR PROGRAM IN DEPT OF CPR								
A B	A B	A B	SPRING GARDEN COLLEGE	CHESTNUT HILL	PA	19118	70	0
CPR PROGRAM IN DEPT OF MAT								
A	A	A	ATLANTIC UNION COLLEGE	S LANCASTER	MA	01561	6	0
CSC PROGRAM IN DEPT OF BAD								
A B	A B	A B	MADONNA COLLEGE	LIVONIA	MI	48150	11	0
A	A	A	DAKOTA STATE COLLEGE	MADISON	SD	57042	17	0
A	A	A	MORRIS HARVEY COLLEGE	CHARLESTON	WV	25304	35	0
A	A	A	DAVIS AND ELKINS COLLEGE	ELKINS	WV	26241	2	0
CSC PROGRAM IN DEPT OF COM								
A B	A B	A B	MESA COLLEGE	GRAND JCT	CO	81501	40	0
CSC PROGRAM IN DEPT OF CSC								
B	B	B	LUTHER COLLEGE	DECORAH	IA	52101	15	0
A B	A B	A B	TAYLOR UNIVERSITY	UPLAND	IN	46989	40	0
A	A	A	CALUMET COLLEGE	WHITING	IN	46394	15	0
B	B	B	TRANSYLVANIA UNIVERSITY	LEXINGTON	KY	40508	10	6
A	A	A	COLUMBIA UNION COLLEGE	TAKOMA PARK	MD	20012	2	0
	B	B	MICHIGAN-FLINT,U OF	FLINT	MI	48503	25	0
	B	B	CONCORDIA C AT MOORHEAD	MOORHEAD	MN	56560	10	0
A	A	A	MISSOURI STHN ST COLLEGE	JOPLIN	MO	64801	135	0
A	A	A	NEW ENG AERONAUTICAL INST	NASHUA	NH	03060	0	0
A	A B	A B	SAINT PETERS COLLEGE	JERSEY CITY	NJ	07306	35	0
B	B	B	MOUNT UNION COLLEGE	ALLIANCE	OH	44601	20	0
B	B	B	GENEVA COLLEGE	BEAVER FALLS	PA	15010	60	0
B	B	B	LOCK HAVEN STATE COLLEGE	LOCK HAVEN	PA	17745	149	0
B	B	B	WEST VA INST TECHNOLOGY	MONTGOMERY	WV	25136	55	0
CSC PROGRAM IN DEPT OF DPR								
A	A	A	SAINT FRANCIS COLLEGE	BROOKLYN	NY	11201	75	0
CSC PROGRAM IN DEPT OF MAT								
B	B	B	CENTRAL U OF IOWA	PELLA	IA	50219	3	0
B	B	B	WESTMINSTER COLLEGE	FULTON	MO	65251	3	0
B	B	B	NC AT WILMINGTON, U OF	WILMINGTON	NC	28401	11	0
B	B	B	JUNIATA COLLEGE	HUNTINGDON	PA	16652	3	0
A	A	A	THIEL COLLEGE	GREENVILLE	PA	16125	10	0
A B	A B	A B	FREED-HARDEMAN COLLEGE	HENDERSON	TN	38340	13	0
	B	B	WESTMINSTER COLLEGE	SALT LAKE CY	UT	84105	4	0
B	B	B	HAMPDEN-SYDNEY COLLEGE	HMPDEN-SYDNEY	VA	23943	0	0
B	B	B	MARY BALDWIN COLLEGE	STAUNTON	VA	24401	10	0
CSC PROGRAM IN DEPT OF MSC								
B	B	B	SAINT AMBROSE COLLEGE	DAVENPORT	IA	52803	29	0
B	B	B	CATAWBA COLLEGE	SALISBURY	NC	28144	10	0
B	B	B	DENISON UNIVERSITY	GRANVILLE	OH	43023	15	0
CSC PROGRAM IN DEPT OF NEC								
B	B	B	GRACELAND COLLEGE	LAMONI	IA	50140	21	0
CST PROGRAM IN DEPT OF COM								
A B	A B	A B	OREGON INST OF TECHNOLOGY	KLAMATH FALLS	OR	97601	97	0
CST PROGRAM IN DEPT OF EET								
A	A	A	GA INST TECHN-STHN TECH	MARIETTA	GA	30060	25	0
DPR PROGRAM IN DEPT OF BAD								
B	B	B	LAMBUTH COLLEGE	JACKSON	TN	38301	31	0
A B	A B	A B	SHEPHERD COLLEGE	SHEPHERDSTOWN	WV	25443	91	0
B	B	B	WEST LIBERTY ST COLLEGE	WEST LIBERTY	WV	26074	27	0
DPR PROGRAM IN DEPT OF BUS								
A	A	A	MIDLAND LUTHERAN COLLEGE	FREMONT	NE	68025	6	0
DPR PROGRAM IN DEPT OF DPR								
A	A	A	MESA COLLEGE	GRAND JCT	CO	81501	15	0
A B	A B	A B	DETROIT COLLEGE OF BUS	DEARBORN	MI	48126	125	0
A B	A B	A B	STEED COLLEGE	JOHNSON CITY	TN	37601	45	0
A B	A B	A B	WEBER STATE COLLEGE	OGDEN	UT	84408	80	0
A	A	A	FAIRMONT STATE COLLEGE	FAIRMONT	WV	26554	47	0
DPR PROGRAM IN DEPT OF NEC								
A	A	A	CAMERON UNIVERSITY	LAWTON	OK	73501	55	0
ISC PROGRAM IN DEPT OF BAD								
B	B	B	RICHARD STOCKTON STATE C	POMONA	NJ	08240	75	0
ISC PROGRAM IN DEPT OF CSC								
B	B	B	CHRISTOPHER NEWPORT C	NEWPORT NEWS	VA	23606	0	0

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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
ISC PROGRAM IN DEPT OF ISC								
A B	A B	A B	QUINCY COLLEGE	QUINCY	IL	62301	4	0
ISY PROGRAM IN DEPT OF BAD								
B	B	B	ROBERT MORRIS COLLEGE	CORAOPOLIS	PA	15108	38	0
ISY PROGRAM IN DEPT OF ISY								
A B	A B	A B	KING'S COLLEGE	WILKES-BARRE	PA	18711	70	0
NSC PROGRAM IN DEPT OF CSC								
B	B	B	US COAST GUARD ACADEMY	NEW LONDON	CT	06320	100	0
OTH PROGRAM IN DEPT OF BAD								
B	B	B	WEST VA INST TECHNOLOGY	MONTGOMERY	WV	25136	93	0
OTH PROGRAM IN DEPT OF CIS								
A	A	B	WASHINGTON TECHNICAL INST	WASHINGTON	DC	20008	320	0
OTH PROGRAM IN DEPT OF COM								
B	B	B	MERCY COLLEGE	DOBBS FERRY	NY	10522	0	0
OTH PROGRAM IN DEPT OF CSC								
B	B	B	MUSKINGUM COLLEGE	NEW CONCORD	OH	43762	0	0
A	A	A	GLENVILLE STATE COLLEGE	GLENVILLE	WV	26351	3	0
OTH PROGRAM IN DEPT OF MAT								
B	B	B	TALLADEGA COLLEGE	TALLADEGA	AL	35160	0	0
B	B	B	WESTMONT COLLEGE	SANTA BARBARA	CA	93108	20	0
		B	ANNHURST COLLEGE	WOODSTOCK	CT	06281	0	0
B	B	B	ALBION COLLEGE	ALBION	MI	49224	12	0
B	B	B	CENTRAL STATE UNIVERSITY	WILBERFORCE	OH	45384	20	0
OTH PROGRAM IN DEPT OF MSC								
B	B	B	WAYNESBURG COLLEGE	WAYNESBURG	PA	15370	17	0
OTH PROGRAM IN DEPT OF NEC								
B	B	B	MD UNIVERSITY COLLEGE , U	COLLEGE PARK	MD	20742	0	0

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GROUP (;MASTERS :) DEGREE PROGRAMS (AS OF JUNE 30, 1977)

YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
CEN PROGRAM IN DEPT OF BAD								
A	A	A	BLACK HILLS STATE COLLEGE	SPEARFISH	SD	57783	16	0
CEN PROGRAM IN DEPT OF EEN								
B M	B M	B M	FLORIDA TECHNOLOGICAL U	ORLANDO	FL	32816	10	20
M	M	M	LOWELL, UNIVERSITY OF	LOWELL	MA	01854	0	20
CIS PROGRAM IN DEPT OF BUS								
B	B	B	SAINT CLOUD ST UNIVERSITY	SAINT CLOUD	MN	56301	25	0
CIS PROGRAM IN DEPT OF CIS								
A B	A B	A B	EASTERN NM U CENTRAL OFF	PORTALES	NM	88130	0	0
A B	A B	A B	LA SALLE COLLEGE	PHILADELPHIA	PA	19141	75	0
CPR PROGRAM IN DEPT OF CIS								
A	A	A	NICHOLLS STATE UNIVERSITY	THIBODAUX	LA	70301	82	0
CPR PROGRAM IN DEPT OF ISY								
A B	A B	A B	PURDUE U CALUMET CAMPUS	HAMMOND	IN	46323	205	0
CPR PROGRAM IN DEPT OF MAT								
B	B	B	HARDING COLLEGE MAIN CAM	SEARCY	AR	72143	10	0
CSC PROGRAM IN DEPT OF BUS								
	B	B	TROY ST U DOTHN-FT RUCKER	DOTHAN	AL	36301	2	0
B	B	B	BETHANY NAZARENE COLLEGE	BETHANY	OK	73008	12	0
CSC PROGRAM IN DEPT OF CCS								
A	A	A	UNION COLLEGE	BARBOURVILLE	KY	40906	0	0
CSC PROGRAM IN DEPT OF CIS								
B	B	B	NICHOLLS STATE UNIVERSITY	THIBODAUX	LA	70301	145	0
B	B	B	SAINT THOMAS, COLLEGE OF	SAINT PAUL	MN	55105	36	0
B	B	B	IONA COLLEGE	NEW ROCHELLE	NY	10801	12	0
B	B	B	CHEYNEY STATE COLLEGE	CHEYNEY	PA	19319	50	0
B M	B M	B M	TRINITY UNIVERSITY	SAN ANTONIO	TX	78284	70	31
	B	B	MARSHALL UNIVERSITY	HUNTINGTON	WV	25701	0	0
CSC PROGRAM IN DEPT OF CON								
B	B	B	KEAN C OF NEW JERSEY	UNION	NJ	07083	275	0
B M	B M	B M	HOUSTON CLEAR LAKE CITY,	HOUSTON	TX	77058	75	124
CSC PROGRAM IN DEPT OF CSC								
B	B	B	ARK AT LITTLE ROCK, U OF	LITTLE ROCK	AR	72204	90	20
B M	B M	B M	CAL STATE U-FULLERTON	FULLERTON	CA	92634	301	79
B M	B M	B M	CAL STATE U-CHICO	CHICO	CA	95929	295	60
B	B	B	CAL STATE POLY U-POMONA	POMONA	CA	91768	80	0
A	A	A	COLUMBUS COLLEGE	COLUMBUS	GA	31907	12	0
B M	B M	B M	BRADLEY UNIVERSITY	PEORIA	IL	61625	100	10
B	B	B	OLIVET NAZARENE COLLEGE	KANKAKEE	IL	60901	10	0
B	B	B	CHICAGO STATE UNIVERSITY	CHICAGO	IL	60628	20	0
A B	A B	A B	EVANSVILLE, UNIVERSITY OF	EVANSVILLE	IN	47702	55	0
B	B	B	ROSE-HULMAN INST OF TECHN	TERRE HAUTE	IN	47803	65	0
B	B	B	ANDERSON COLLEGE	ANDERSON	IN	46011	32	0
A B	A B	A B	KENTUCKY STATE UNIVERSITY	FRANKFORT	KY	40601	109	0
A B	A B	A B	LOYOLA U IN NEW ORLEANS	NEW ORLEANS	LA	70118	0	0
B	B	B	SOUTHERN U A & M C CEN OF	BATON ROUGE	LA	70813	223	0
B	B	B	SAINT MARY'S COLLEGE	WINONA	MN	55987	8	0
B	B	B	SAINT CLOUD ST UNIVERSITY	SAINT CLOUD	MN	56301	86	0
B	B	B	MOORHEAD STATE UNIVERSITY	MOORHEAD	MN	56560	112	0
B M	B M	B M	MANKATO STATE UNIVERSITY	MANKATO	MN	56001	250	25
A B	A B	A B	STHEST MO ST UNIVERSITY	CPE GIRARDEAU	MO	63701	220	0
B M	B M	B M	JACKSON STATE UNIVERSITY	JACKSON	MS	39217	300	30
B	B	B	EASTERN NM U CENTRAL OFF	PORTALES	NM	88130	0	0
B M D	B M D	B M D	CUNY CITY COLLEGE	NEW YORK	NY	10031	412	60
B M	B M	B M	NY INST TECHN MAIN CAMPUS	OLD WESTBURY	NY	11568	75	40
B	B	B	SUNY COLLEGE AT OSWEGO	OSWEGO	NY	13126	291	0
B	B	B	LONG IS U C W POST CENTER	GREENVALE	NY	11548	62	0
B	B	B	VASSAR COLLEGE	POUGHKEEPSIE	NY	12601	3	0
B M	B M	B M	ROCHESTER INST TECHNOLOGY	ROCHESTER	NY	14623	530	160
B M	B M	B M	NY INST TECHN NY CTY CAM	NEW YORK	NY	10023	120	20
B M	B M	B M	WRIGHT ST U CENTRAL OFF	DAYTON	OH	45431	171	76
B	B	B	ANTIOCH COLLEGE	YELLOW SPG	OH	45387	10	0
B	B	B	STHWSTN OKLA STATE U	WEATHERFORD	OK	73096	35	0
A B	A B	A B	SCRANTON,UNIVERSITY OF	SCRANTON	PA	18510	110	0
B	B	B	WESTMINSTER COLLEGE	NEW WILMINGTN	PA	16142	25	0
A B	A B M	A B M	WORLD UNIVERSITY	HATO REY	PR	00917	27	0
B	B	B	FURMAN UNIVERSITY	GREENVILLE	SC	29613	39	0
A	A	A B	TENN AT CHATTANOOGA, U OF	CHATTANOOGA	TN	37401	20	0
B	B	B	AUSTIN PEAY ST UNIVERSITY	CLARKSVILLE	TN	37040	0	0
B	B	B	ANGELO STATE UNIVERSITY	SAN ANGELO	TX	76901	100	0
B	B	B	SNT MARY'S U SAN ANTONIO	SAN ANTONIO	TX	78284	10	0
B	B	B M	TEX A&I U CORPUS CHRISTI	CORPUS CHRISTI	TX	78411	32	0
B	B	B	AUSTIN COLLEGE	SHERMAN	TX	75090	0	0
B	B	B	STHWST TEX ST UNIVERSITY	SAN MARCOS	TX	78666	100	0

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	B	B	SEATTLE PACIFIC UNIVERSIT	SEATTLE	WA	98119	50	0
B	B	B	WISCONSIN LA CROSSE, U OF	LA CROSSE	WI	54601	214	0
A	A	A B	WISCONSIN EAU CLAIRE, U O	EAU CLAIRE	WI	54701	40	0
CSC PROGRAM IN DEPT OF ICS								
B	B	B	PITTSBURG STATE UNIVERSIT	PITTSBURG	KS	66762	33	0
CSC PROGRAM IN DEPT OF MAT								
A	A	A	POINT LOMA COLLEGE	SAN DIEGO	CA	92106	20	0
B	B	B	CENTRAL CONN ST COLLEGE	NEW BRITAIN	CT	06050	52	0
A	A	A	WEST GEORGIA COLLEGE	CARROLLTON	GA	30118	0	0
B	B	B	PURDUE U CALUMET CAMPUS	HAMMOND	IN	46323	8	0
A B	A B	A B	WASHBURN U OF TOPEKA	TOPEKA	KS	66621	31	0
B	B	B	NORTHERN MICH UNIVERSITY	MARQUETTE	MI	49855	23	0
B	B	B	CENTRAL MO ST UNIVERSITY	WARRENSBURG	MO	64093	58	0
A	A	A	ALCORN STATE UNIVERSITY	LORMAN	MS	39096	56	0
	B	B	EAST CAROLINA UNIVERSITY	GREENVILLE	NC	27834	0	0
B	B	B	KEARNEY STATE COLLEGE	KEARNEY	NE	68847	55	0
B	B	B	EAST STROUDSBG ST COLLEGE	E STROUDSBURG	PA	18301	80	0
B	B	B	PR MAYAGUEZ U OF	MAYAGUEZ	PR	00708	40	0
B	B	B	STHWST TEX ST UNIVERSITY	SAN MARCOS	TX	78666	110	0
B	B	B	WISCONSIN SUPERIOR,U OF	SUPERIOR	WI	54880	0	0
A B	A B	A B	WEST VA WESLEYAN COLLEGE	BUCKHANNON	WV	26201	13	0
CSC PROGRAM IN DEPT OF MCS								
B	B	B	WESTERN WASH ST COLLEGE	BELLINGHAM	WA	98225	100	0
CSC PROGRAM IN DEPT OF MSC								
B	B M	B M	NORTH FLORIDA, U OF	JACKSONVILLE	FL	32216	387	0
B	B	B	BUTLER UNIVERSITY	INDIANAPOLIS	IN	46208	10	0
B	B	B	INDIANA-PURDUE U AT FORT	FORT WAYNE	IN	46805	19	0
B	B	B	WESTERN KY UNIVERSITY	BOWLING GREEN	KY	42101	86	0
B	B	B	EASTERN KY UNIVERSITY	RICHMOND	KY	40475	10	0
B	B	B	TOWSON STATE UNIVERSITY	BALTIMORE	MD	21204	167	0
B	B	B	NTHWST MO ST UNIVERSITY	MARYVILLE	MO	64468	37	0
A	A	A	MONTANA C MINRL SCI-TECHN	BUTTE	MT	59701	10	0
B	B	B	TRENTON STATE COLLEGE	TRENTON	NJ	08625	60	0
B	B	B	SUNY COLLEGE AT BROCKPORT	BROCKPORT	NY	14420	195	0
CSC PROGRAM IN DEPT OF NEC								
B	B	B	LEWIS UNIVERSITY	LOCKPORT	IL	60441	31	0
B	B	B	LOYOLA COLLEGE	BALTIMORE	MD	21210	46	0
B	B	B	MONMOUTH COLLEGE	W LONG BRANCH	NJ	07764	116	0
	B	B	WILKES COLLEGE	WILKES-BARRE	PA	18703	6	0
CSC PROGRAM IN DEPT OF SCS								
B M	B M	B M	CAL POLY ST U-SN LUIS OB	SN LUIS OBSPO	CA	93407	305	35
CSE PROGRAM IN DEPT OF EEN								
B M	B M	B M	CAL STATE U-LONG BEACH	LONG BEACH	CA	90840	90	30
CST PROGRAM IN DEPT OF IEN								
B M	B M	B M	NEW HAVEN, UNIVERSITY OF	WEST HAVEN	CT	06516	37	40
CST PROGRAM IN DEPT OF MAT								
A	A	A	EDINBORO STATE COLLEGE	EDINBORO	PA	16444	24	0
CTE PROGRAM IN DEPT OF BAD								
A	A	A	INDIANA CENTRAL UNIVERSIT	INDIANAPOLIS	IN	46227	10	0
CTE PROGRAM IN DEPT OF CTE								
A B	A B	A B	INDIANA-PURDUE U AT FORT	FORT WAYNE	IN	46805	620	0
DPR PROGRAM IN DEPT OF BAD								
B	B	B	FORT HAYS ST UNIV	HAYS	KS	67601	38	0
A B	A B	A B	EASTERN KY UNIVERSITY	RICHMOND	KY	40475	121	0
A B	A B	A B	MOREHEAD STATE UNIVERSITY	MOREHEAD	KY	40351	53	0
A	A	A	NORTHERN KY UNIVERSITY	HIGHLAND HTS	KY	41076	200	0
B	B	B	BALTIMORE, UNIVERSITY OF	BALTIMORE	MD	21201	104	0
A B	A B	A B	CENTRAL MO ST UNIVERSITY	WARRENSBURG	MO	64093	128	0
B	B	B	MISS UNIVERSITY FOR WOMEN	COLUMBUS	MS	39701	45	0
B	B	B	CAMPBELL COLLEGE	BUIES CREEK	NC	27506	20	0
A B	A B	A B	ELMIRA COLLEGE	ELMIRA	NY	14901	72	0
B	B	B	WISCONSIN SUPERIOR,U OF	SUPERIOR	WI	54880	70	0
DPR PROGRAM IN DEPT OF BUS								
B	B	B	ARKANSAS STATE U MAIN CAM	STATE UNIV	AR	72467	65	0
A B M	A B M	A B M	EMPORIA STATE UNIV	EMPORIA	KS	66801	74	7
B	B	B	STHWST MO ST UNIVERSITY	SPRINGFIELD	MO	65802	104	0
DPR PROGRAM IN DEPT OF CON								
A	A	A	NORTHERN MICH UNIVERSITY	MARQUETTE	MI	49855	51	0
DPR PROGRAM IN DEPT OF CSC								
B	B	B	LIVINGSTON UNIVERSITY	LIVINGSTON	AL	35470	70	0

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DPR PROGRAM IN DEPT OF DPR								
B	B	B	CAL STATE POLY U-POMONA	POMONA	CA	91768	291	0
B	B	B	FLA AGRICULTURAL & MECH.	TALLAHASSEE	FL	32307	65	0
A B	A B	A B	FERRIS STATE COLLEGE	BIG RAPIDS	MI	49307	375	0
B	B	B	WILLIAM CAREY COLLEGE	HATTIESBURG	MS	39401	5	0
DPR PROGRAM IN DEPT OF NEC								
A	A	A	WESTERN KY UNIVERSITY	BOWLING GREEN	KY	42101	55	0
	A	A	LINCOLN UNIVERSITY	JEFFERSON CY	MO	65101	2	0
A	A	A	PR MAYAGUEZ, U OF	MAYAGUEZ	PR	00708	149	0
ICS PROGRAM IN DEPT OF ICS								
B	B	B	NTHESTN ILL UNIVERSITY	CHICAGO	IL	60625	182	0
A B	A B	A B	SAINT JOSEPH'S COLLEGE	RENSSELAER	IN	47978	75	0
IPR PROGRAM IN DEPT OF CIS								
B	B	B	MANSFIELD STATE COLLEGE	MANSFIELD	PA	16933	90	0
ISC PROGRAM IN DEPT OF BAD								
	B	B	NOTRE DAME, COLLEGE OF	BELMONT	CA	94002	0	0
B	B	B	BOISE STATE UNIVERSITY	BOISE	ID	83725	64	0
ISC PROGRAM IN DEPT OF CSC								
B	B	B	ARKANSAS TECH UNIVERSITY	RUSSELLVILLE	AR	72801	55	0
ISC PROGRAM IN DEPT OF ISY								
B	B	B	WSTN CAROLINA UNIVERSITY	CULLOWHEE	NC	28723	39	0
ISC PROGRAM IN DEPT OF MAT								
B	B	B	MARYVILLE COLLEGE	SAINT LOUIS	MO	63141	0	0
ISY PROGRAM IN DEPT OF BAD								
B	B	B	CLARION STATE C CEN OFF	CLARION	PA	16214	25	0
B M	B M	B M	MARYWOOD COLLEGE	SCRANTON	PA	18509	21	89
ISY PROGRAM IN DEPT OF BUS								
B	B	B	JAMES MADISON UNIVERSITY	HARRISONBURG	VA	22801	13	0
ISY PROGRAM IN DEPT OF CIS								
B	B	B	BENTLEY COLLEGE	WALTHAM	MA	02154	125	0
ISY PROGRAM IN DEPT OF ICS								
A B	A B	A B	PITTSBURG STATE UNIVERSIT	PITTSBURG	KS	66762	66	0
ISY PROGRAM IN DEPT OF ISY								
A B	A B	A B	ALABAMA STATE UNIVERSITY	MONTGOMERY	AL	36101	110	0
A B	A B	A B M	QUINNIPIAC COLLEGE	HAMDEN	CT	06518	150	0
B	B	B	SUNY COLLEGE AT BUFFALO	BUFFALO	NY	14222	120	0
B	B	B	VIRGINIA STATE COLLEGE	PETERSBURG	VA	23803	80	0
ISY PROGRAM IN DEPT OF NEC								
B	B	B	WISCONSIN EAU CLAIRE, U O	EAU CLAIRE	WI	54701	160	0
NEC PROGRAM IN DEPT OF NEC								
M	M	M	LONG IS U C W POST CENTER	GREENVALE	NY	11548	0	62
OTH PROGRAM IN DEPT OF BAD								
B	B	B	INDIANA U AT SOUTH BEND	SOUTH BEND	IN	46615	8	0
OTH PROGRAM IN DEPT OF CIS								
B	B	B	SLIPPERY ROCK ST COLLEGE	SLIPPERY ROCK	PA	16057	0	0
OTH PROGRAM IN DEPT OF COM								
B	B	B	CALIFORNIA STATE COLLEGE	CALIFORNIA	PA	15419	80	0
B	B	B	RADFORD COLLEGE	RADFORD	VA	24142	0	0
	B	B	GONZAGA UNIVERSITY	SPOKANE	WA	99258	0	0
OTH PROGRAM IN DEPT OF ENG								
	B	B	TRINITY COLLEGE	HARTFORD	CT	06106	12	0
OTH PROGRAM IN DEPT OF ISY								
B	B	B	AUBURN U AT MONTGOMERY	MONTGOMERY	AL	36109	65	0
OTH PROGRAM IN DEPT OF MAT								
B	B	B	NORTHERN IOWA, U OF	CEDAR FALLS	IA	50613	31	0
B	B	B	EASTERN ILL UNIVERSITY	CHARLESTON	IL	61920	32	0
A	A	A	MANCHESTER COLLEGE	N MANCHESTER	IN	46962	9	0
B	B	B	SAINT FRANCIS COLLEGE	LORETTO	PA	15940	12	0
B	B	B	BEAVER COLLEGE	GLENSIDE	PA	19038	65	0
OTH PROGRAM IN DEPT OF MSC								
B	B	B	WASHINGTON COLLEGE	CHESTERTOWN	MD	21620	10	0

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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
B	B	B	WASHINGTON AND LEE U	LEXINGTON	VA	24450	20	0
OTH PROGRAM IN DEPT OF NEC								
B	B	B	EASTERN ILL UNIVERSITY	CHARLESTON	IL	61920	105	0
B	B	B	DEPAUW UNIVERSITY	GREENCASTLE	IN	46135	20	0
B	B	B	RIDER COLLEGE	LAWRENCEVILLE	NJ	08648	140	0
SAN PROGRAM IN DEPT OF BAD								
A	A	A	NORTHERN STATE COLLEGE	ABERDEEN	SD	57401	20	0
SCS PROGRAM IN DEPT OF SCS								
B	B	B M	WESTERN ILLINOIS UNIVERSI	MACOMB	IL	61455	129	0
SYS PROGRAM IN DEPT OF SYS								
B M	B M	B M	WEST FLORIDA, U OF	PENSACOLA	FL	32504	180	4

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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
CEN PROGRAM IN DEPT OF CSE								
B M D	B M D	B M D	CASE WESTERN RESERVE U	CLEVELAND	OH	44106	115	60
CEN PROGRAM IN DEPT OF EEN								
	M	B M D	ARIZONA, UNIVERSITY OF	TUCSON	AZ	85721	0	15
B M D	B M D	B M D	CAL-DAVIS, U OF	DAVIS	CA	95616	0	0
	B	B	IOWA STATE U SCI & TECHN	AMES	IA	50010	0	0
B	B	B	ILL URBANA CAMPUS,U OF	URBANA	IL	61801	199	0
B M D	B M D	B M D	MASS AMHERST CAMPUS, U OF	AMHERST	MA	01003	150	60
B	B	B	MONTANA STATE UNIVERSITY	BOZEMAN	MT	59717	6	0
CEN PROGRAM IN DEPT OF EMG								
B M	B M	B M	BOSTON UNIVERSITY	BOSTON	MA	02215	100	30
CIS PROGRAM IN DEPT OF CIS								
B M D	B M D	B M D	OHIO STATE U CENTRAL OFF	COLUMBUS	OH	43210	470	176
B M	B M	B M	TEMPLE UNIVERSITY	PHILADELPHIA	PA	19122	100	60
CPR PROGRAM IN DEPT OF SCS								
B	B	B M	UTAH STATE UNIVERSITY	LOGAN	UT	84322	60	0
CSC PROGRAM IN DEPT OF CIS								
B M D	B M D	B M D	ALABAMA IN BIRMINGHAM, U	BIRMINGHAM	AL	35294	50	64
M D	B M D	B M D	MASS AMHERST CAMPUS, U OF	AMHERST	MA	01003	0	71
B	B	B M D	CUNY BROOKLYN COLLEGE	BROOKLYN	NY	11210	360	0
B M	B M	B M	CLEVELAND ST UNIVERSITY	CLEVELAND	OH	44115	180	25
M	B M	B M	OKLA STATE U MAIN CAMPUS	STILLWATER	OK	74074	0	40
CSC PROGRAM IN DEPT OF COM								
M	M	M	ALABAMA,THE U OF	UNIVERSITY	AL	35486	0	12
B	B	B	MAINE AT ORONO, U OF	ORONO	ME	04473	30	0
B	B	B M	NEW HAMPSHIRE,U OF	DURHAM	NH	03824	70	1
B M	B M	B M	FARLGH DCKSN TEANECK CAM	TEANECK	NJ	07666	79	202
B	B	B	TENNESSEE TECHNOLOGICAL U	COOKEVILLE	TN	38501	67	0
CSC PROGRAM IN DEPT OF ESC								
M	M	M	UNIV OF ALABAMA IN HUNTSV	HUNTSVILLE	AL	35807	0	20
M	M	M	ARKANSAS MAIN CAMPUS,U OF	FAYETTEVILLE	AR	72701	0	5
B	B	B	NORTHERN ARIZ UNIVERSITY	FLAGSTAFF	AZ	86001	56	0
M D	M D	M D	CAL-LOS ANGELES, U OF	LOS ANGELES	CA	90024	0	274
M D	M D	M D	STANFORD UNIVERSITY	STANFORD	CA	94305	0	160
B M D	B M D	B M D	SOUTHERN CALIFORNIA, U OF	LOS ANGELES	CA	90007	200	150
M D	M D	M D	COLORADO AT BOULDER,U OF	BOULDER	CO	80309	0	106
M	M	M	HOWARD UNIVERSITY	WASHINGTON	DC	20059	0	28
B M	B M	B M	MIAMI, UNIVERSITY OF	CORAL GABLES	FL	33124	65	20
B	B	B	DRAKE UNIVERSITY	DES MOINES	IA	50311	10	0
B M D	B M D	B M D	IOWA, UNIVERSITY OF	IOWA CITY	IA	52242	140	70
B M D	B M D	B M D	IOWA STATE U SCI & TECHN	AMES	IA	50010	302	47
B M	B M	B M	STHN ILLINOIS U CARBONDL	CARBONDALE	IL	62901	150	25
B M D	B M D	B M D	NORTHWES.ERN UNIVERSITY	EVANSTON	IL	60201	93	108
B M D	B M D	B M D	ILLINOIS INSTITUTE OF TEC	CHICAGO	IL	60616	225	120
B M D	B M D	B M D	ILL URBANA CAMPUS,U OF	URBANA	IL	61801	528	224
B M	B M	B M D	INDIANA U AT BLOOMINGTON	BLOOMINGTON	IN	47401	150	70
B M D	B M D	B M D	PURDUE U MAIN CAMPUS	LAFAYETTE	IN	47907	220	110
B M D	B M D	B M D	KANSAS STATE UNIVERSITY	MANHATTAN	KS	66506	120	70
B M D	B M D	B M D	UNIVERSITY OF KANSAS (LAW	LAWRENCE	KS	66045	151	67
B	B	B	LA STATE U AND A&M C	BATON ROUGE	LA	70803	136	0
B	B	B	NORTHEAST LOUISIANA U	MONROE	LA	71209	32	0
B M D	B M D	B M D	WORCESTER POLY INSTITUTE	WORCESTER	MA	01609	200	220
B M D	B M D	B M D	MD COLLEGE PARK CAM, U OF	COLLEGE PARK	MD	20742	464	220
B M D	B M D	B M D	MICHIGAN STATE UNIVERSITY	EAST LANSING	MI	48824	235	57
B M D	B M D	B M D	MINN MNPLS SNT PAUL,U OF	MINNEAPOLIS	MN	55455	200	125
	M	M	MISSOURI-COLUMBIA, U OF	COLUMBIA	MO	65201	0	35
B M D	B M D	B M D	UNIVERSITY OF MISSOURI-RO	ROLLA	MO	65401	215	111
B M	B M	B M	SOUTHERN MISSISSIPPI,U OF	HATTIESBURG	MS	39401	250	25
B M	B M	B M	MISSISSIPPI ST UNIVERSITY	MS STATE	MS	39762	132	29
B	B	B M	MISSISSIPPI MAIN CAM, U O	UNIVERSITY	MS	38677	53	0
B	B	B	MONTANA STATE UNIVERSITY	BOZEMAN	MT	59717	0	0
B	B	B	MONTANA, UNIVERSITY OF	MISSOULA	MT	59801	55	0
B	B M	B M	NC STATE U RALEIGH	RALEIGH	NC	27607	415	7
B M D	B M D	B M D	DUKE UNIVERSITY	DURHAM	NC	27706	50	21
B M D	B M D	B M D	NC AT CHAPEL HILL, U OF	CHAPEL HILL	NC	27514	10	150
B	B	B	ND CENTRAL OFFICE, U OF	GRAND FORKS	ND	58201	110	0
B M	B M	B M	NM INST OF MINING & TECHN	SOCORRO	NM	87801	50	8
B M	B M	B M	SUNY AT ALBANY	ALBANY	NY	12222	123	42
B	B	B	HOFSTRA UNIVERSITY	HEMPSTEAD	NY	11550	123	0
A B	A B	A B	ST JOHN'S UNIVERSITY	JAMAICA	NY	11439	99	0
M	M D	M D	ROCHESTER, UNIVERSITY OF	ROCHESTER	NY	14627	0	17
B M	B M	B M	BOWLING GRN ST U MAIN CAM	BOWLING GREEN	OH	43403	175	35
B M	B M	B M	DAYTON, UNIVERSITY OF	DAYTON	OH	45469	125	45
B	B	B	OHIO UNIVERSITY	ATHENS	OH	45701	50	0
B	B	B	TULSA, UNIVERSITY OF	TULSA	OK	74104	35	0
B M	B M	B M	OREGON MAIN CAMPUS, U OF	EUGENE	OR	97403	130	63
B	B	B	INDIANA U OF PA MAIN CAM	INDIANA	PA	15701	92	0
B M D	B M D	B M D	UNIV. OF PITTSBURGH	PITTSBURGH	PA	15260	175	65

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GROUP I (DOCTORATE)] CONTINUED DEGREE PROGRAMS
(AS OF JUNE 30, 1977)

YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
B M D	B M D	B M D	PA STATE UNIV PARK CAMPUS	UNIVERSITY PK	PA	16802	440	67
B	B	B	SD MAIN CAMPUS, U OF	VERMILLION	SD	57069	58	0
B	B	B M	STEPHEN F AUSTIN STATE U	NACOGDOCHES	TX	75962	150	0
	B	B	SAM HOUSTON ST UNIVERSITY	HUNTSVILLE	TX	77340	0	0
B M D	B M D	B M D	TEXAS A&M UNIVERSITY	COLLEGE STA	TX	77843	475	80
B M D	B M D	B M D	UNIVERSITY OF TEXAS AT AU	AUSTIN	TX	78712	474	164
B	B	B	TEXAS CHRISTIAN U	FORT WORTH	TX	76129	48	0
B M D	B M D	B M D	VA POLY INST AND STATE U	BLACKSBURG	VA	24061	304	68
B	B	B	OLD DOMINION UNIVERSITY	NORFOLK	VA	23508	150	0
M D	B M D	B M D	WASHINGTON, UNIVERSITY OF	SEATTLE	WA	98195	58	75
B M D	B M D	B M D	WASHINGTON ST UNIVERSITY	PULLMAN	WA	99164	115	50
B M D	B M D	B M D	WISCONSIN MADISON, U OF	MADISON	WI	53706	65	176
B	B M	B M	WYOMING, UNIVERSITY OF	LARAMIE	WY	82071	55	0
CSC PROGRAM IN DEPT OF EEN								
B M	B M	B M	SOUTH FLORIDA,U OF	TAMPA	FL	33620	113	26
B M D	B M D	B M D	POLYTECHNIC INST NEW YORK	BROOKLYN	NY	11201	53	212
CSC PROGRAM IN DEPT OF ENG								
B	B	B	OAKLAND UNIVERSITY	ROCHESTER	MI	48063	175	0
CSC PROGRAM IN DEPT OF ICS								
B	B	B	TEXAS SOUTHERN UNIVERSITY	HOUSTON	TX	77004	232	0
CSC PROGRAM IN DEPT OF IEN								
B	B	B	ARKANSAS MAIN CAMPUS,U OF	FAYETTEVILLE	AR	72701	10	0
B M D	B M D	B M D	ARIZONA STATE UNIVERSITY	TEMPE	AZ	85281	48	25
CSC PROGRAM IN DEPT OF MAT								
B M	B M	B M	ARIZONA STATE UNIVERSITY	TEMPE	AZ	85281	80	30
B	B M	B M	DENVER, UNIVERSITY OF	DENVER	CO	80208	25	12
	B	B	HARTFORD,UNIVERSITY OF	WEST HARTFORD	CT	06117	0	0
B M	B M	B M	FLORIDA STATE UNIVERSITY	TALLAHASSEE	FL	32306	60	6
B	B	B	ILL CHICAGO CIRCLE, U OF	CHICAGO	IL	60680	253	0
B	B	B	ILLINOIS STATE UNIVERSITY	NORMAL	IL	61761	36	0
B	B	B	TULANE U OF LOUISIANA	NEW ORLEANS	LA	70118	20	0
B M D	B M D	B M D	BOSTON UNIVERSITY	BOSTON	MA	02215	15	15
M D	M D	M D	UNIVERSITY OF MICHIGAN	ANN ARBOR	MI	48109	0	0
M	M	M	DETROIT, UNIVERSITY OF	DETROIT	MI	48221	0	28
M	B M	B M	WESTERN MICH UNIVERSITY	KALAMAZOO	MI	49008	0	40
B	B	B	SAINT LOUIS U	SAINT LOUIS	MO	63103	15	0
B M	B M	B M	ND STATE U MAIN CAMPUS	FARGO	ND	58102	53	4
	M	M	OHIO UNIVERSITY	ATHENS	OH	45701	0	2
M	M	M	LEHIGH UNIVERSITY	BETHLEHEM	PA	18015	0	8
CSC PROGRAM IN DEPT OF MSC								
B M	B M	B M	ARKANSAS MAIN CAMPUS,U OF	FAYETTEVILLE	AR	72701	15	10
B	B	B	LOYOLA U OF CHICAGO	CHICAGO	IL	60611	40	0
B M	B M	B M	INDIANA-PURDUE AT INDIANA	INDIANAPOLIS	IN	46205	0	0
B M D	B M D	B M D	RENSSELAER POLY INSTITUTE	TROY	NY	12181	158	42
B	B	B	DREXEL UNIVERSITY	PHILADELPHIA	PA	19104	56	0
B M D	B M D	B M D	TEXAS AT DALLAS,U OF	RICHARDSON	TX	75080	40	85
B M	B M	B M	VIRGINIA COMMONWEALTH U	RICHMOND	VA	23284	20	15
CSC PROGRAM IN DEPT OF NEC								
B M D	B M D	B M D	CAL-SAN DIEGO, U OF	LA JOLLA	CA	92093	200	41
M D	M D	M D	CAL - DAVIS, U OF	DAVIS	CA	95616	0	0
B	B	B	KENT STATE U., KENT CAMPU	KENT	OH	44242	91	0
B M D	B M D	B M D	BROWN UNIVERSITY	PROVIDENCE	RI	02912	51	35
	B	B	WILLIAM & MARY MAIN CAM,	WILLIAMSBURG	VA	23185	60	0
CSC PROGRAM IN DEPT OF SCS								
B M D	B M D	B M D	GEORGIA, UNIVERSITY OF	ATHENS	GA	30602	536	50
B M	B M	B M	RHODE ISLAND,U OF	KINGSTON	RI	02881	18	19
CSE PROGRAM IN DEPT OF COM								
M	M	M	WILLIAM & MARY MAIN CAM,	WILLIAMSBURG	VA	23185	0	50
CSE PROGRAM IN DEPT OF CSC								
B M D	B M D	B M D	WASHINGTON UNIVERSITY	SAINT LOUIS	MO	63130	55	29
CSE PROGRAM IN DEPT OF CSE								
B M D	B M D	B M D	ILL CHICAGO CIRCLE, U OF	CHICAGO	IL	60680	95	25
M	M	M	TEXAS AT ARLINGTON, U OF	ARLINGTON	TX	76019	0	110
CSE PROGRAM IN DEPT OF EEN								
B M D	B M D	B M D	ARIZONA STATE UNIVERSITY	TEMPE	AZ	85281	175	175
B M D	B M D	B M D	CAL-SANTA BARBARA,U OF	SANTA BARBARA	CA	93106	139	227
B	B	B	COLORADO AT BOULDER, U OF	BOULDER	CO	80309	0	0
B	B	B	UNIVERSITY OF HARTFORD	WEST HARTFORD	CT	06117	5	0
B M D	B M D	B M D	MD COLLEGE PARK CAM, U OF	COLLEGE PARK	MD	20742	245	58
CSE PROGRAM IN DEPT OF NEC								
B M D	B M D	B M D	MASSACHUSETTS INST OF TEC	CAMBRIDGE	MA	02139	101	50

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GROUP (;DOCTORATE;) CONTINUED

DEGREE PROGRAMS
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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
CST PROGRAM IN DEPT OF ENG								
B	B	B	MEMPHIS STATE UNIVERSITY	MEMPHIS	TN	38152	57	0
CST PROGRAM IN DEPT OF NEC								
A	A	A	BOWLING GRN ST FIRELANDS	HURON	OH	44839	10	0
CTE PROGRAM IN DEPT OF BAD								
A	A	A	NTHWSTN ST U OF LA	NATCHITOCHES	LA	71457	5	0
CTE PROGRAM IN DEPT OF CTE								
A	A	A	PURDUE U NORTH CENTRAL	WESTVILLE	IN	46391	37	0
A	A	A	TOLEDO,UNIVERSITY OF	TOLEDO	OH	43606	174	0
DPR PROGRAM IN DEPT OF BAD								
B	B	B	NORTHERN ARIZ UNIVERSITY	FLAGSTAFF	AZ	86001	100	0
B	B	B	NORTHEAST LOUISIANA U	MONROE	LA	71209	256	0
B	B	B	WESTERN MICH UNIVERSITY	KALAMAZOO	MI	49008	25	0
M D	M D	M D	UNIV OF MICH	ANN ARBOR	MI	48109	0	39
DPR PROGRAM IN DEPT OF BUS								
A	A	A	AKRON CENTRAL OFF, U OF	AKRON	OH	44325	342	0
DPR PROGRAM IN DEPT OF DPR								
B	B	B	ARKANSAS, U OF	FAYETTEVILLE	AR	72701	76	0
A	A	A	STHN ILLINOIS U CABONDL	CARBONDALE	IL	62901	75	0
DPR PROGRAM IN DEPT OF ENG								
A	A	A	LOUISVILLE,UNIVERSITY OF	LOUISVILLE	KY	40208	65	0
ICS PROGRAM IN DEPT OF BAD								
B	B	B	IDAHO STATE UNIVERSITY	POCATELLO	ID	83209	15	0
ICS PROGRAM IN DEPT OF ICS								
B M D	B M D	B M D	U OF CAL-IRVINE	IRVINE	CA	92717	270	70
B M D	B M D	B M D	GA INST OF TECH MAIN CAM	ATLANTA	GA	30332	250	147
ISC PROGRAM IN DEPT OF BAD								
	B	B	GOLDEN GATE UNIVERSITY	SAN FRANCISCO	CA	94105	20	0
ISC PROGRAM IN DEPT OF ISC								
B M D	B M D	B M D	CAL-SANTA CRUZ, U OF	SANTA CRUZ	CA	95064	77	19
M D	M D	M D	CAL-SAN FRANCISCO, U OF	SAN FRANCISCO	CA	94143	0	3
ISC PROGRAM IN DEPT OF NEC								
M	M	M	CATHOLIC U OF AMERICA	WASHINGTON	DC	20064	0	316
ISY PROGRAM IN DEPT OF BAD								
B	B	B	COLORADO AT BOULDER,U OF	BOULDER	CO	80309	30	0
B	B	B	TOLEDO,UNIVERSITY OF	TOLEDO	OH	43606	30	[illegible]
B M D	B M D	B M D	WISCONSIN MADISON, U OF	MADISON	WI	53706	0	1[illegible]
ISY PROGRAM IN DEPT OF COM								
B M	B M	B M	BOWLING GRN ST U MAIN CAM	BOWLING GREEN	OH	43403	105	8
ISY PROGRAM IN DEPT OF EEN								
B M D	B M D	B M D	STANFORD UNIVERSITY	STANFORD	CA	94305	47	102
ISY PROGRAM IN DEPT OF IEN								
B M D	B M D	B M D	THE UNIVERSITY OF MICHIGA	ANN ARBOR	MI	48109	59	40
ISY PROGRAM IN DEPT OF ISY								
B	B	B	DRAKE UNIVERSITY	DES MOINES	IA	50311	37	0
B	B	B	MD COLLEGE PARK CAM U OF	COLLEGE PARK	MD	20742	78	0
M D	M D	M D	MINN MNPLS SNT PAUL, U OF	MINNEAPOLIS	MN	55455	0	116
B	B	B	MIDDLE TENN ST UNIVERSITY	MURFREESBORO	TN	37130	80	0
B	B	B M	NORTH TEXAS ST UNIVERSITY	DENTON	TX	76203	100	0
A B M	A B M	B M	VIRGINIA COMMONWEALTH U	RICHMOND	VA	23284	190	58
ISY PROGRAM IN DEPT OF NEC								
B	B	B	ARIZONA STATE UNIVERSITY	TEMPE	AZ	85281	160	0
M D	M D	M D	MASSACHUSETTS INST OF TEC	CAMBRIDGE	MA	02139	0	0
OTH PROGRAM IN DEPT OF BAD								
	B M D	B M D	GEORGIA, UNIVERSITY OF	ATHENS	GA	30602	25	5
B [illegible]	B M D	[illegible] M D	MINN MNPLS SNT PAUL,U OF	MINNEAPOLIS	MN	55455	443	93
OTH PROGRAM IN DEPT OF CIS								
		B M	SETON HALL UNIVERSITY	SOUTH ORANGE	NJ	07079	0	20
OTH PROGRAM IN DEPT OF CSC								
M D	M D	M D	CAL INST OF TECHNOLOGY	PASADENA	CA	91125	0	12
OTH PROGRAM IN DEPT OF EEN								
D	D	D	SOUTHERN CALIFORNIA, U OF	LOS ANGELES	CA	90007	15	18

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YEAR OFFERED AND DEGREE 1976-77	1977-78	1978-79	NAME OF INSTITUTION	CITY	STATE	ZIPCODE	MAJORS ENROLLED 1976-77 UNDERGRAD	GRADUATE
B	B	B	WESTERN MICH UNIVERSITY	KALAMAZOO	MI	49008	68	0
B M D	B M D	B M D	STEVENS INST TECHNOLOGY	HOBOKEN	NJ	07030	19	50
B M D	B M D	B M D	WISCONSIN MADISON, U OF	MADISON	WI	53706	200	33
OTH PROGRAM IN DEPT OF MSC								
B M D	B M D	B M D	JOHNS HOPKINS UNIVERSITY	BALTIMORE	MD	21218	65	42
OTH PROGRAM IN DEPT OF NEC								
M D	M D	M D	COLO MEDICAL CENTER, U OF	DENVER	CO	80262	0	0
		B	THE CATHOLIC UNIV. OF AME	WASHINGTON	DC	20064	0	0
M	M	M	INDIANA UNIVERSITY	BLOOMINGTON	IN	47401	0	2
B M	B M	B M	SAINT JOHN'S UNIVERSITY	JAMAICA	NY	11439	10	98
OTH PROGRAM IN DEPT OF SCS								
B	B	B	GEORGE WASH UNIVERSITY	WASHINGTON	DC	20052	0	0
SAN PROGRAM IN DEPT OF SAN								
B	B	B	MIAMI UNIVERSITY MAIN CAM	OXFORD	OH	45056	356	0
SCE PROGRAM IN DEPT OF ENG								
B M	B M	B M	LOUISVILLE,UNIVERSITY OF	LOUISVILLE	KY	40208	100	20
SEN PROGRAM IN DEPT OF ENG								
M	M	M	MAINE AT ORONO, U OF	ORONO	ME	04473	0	2
SEN PROGRAM IN DEPT OF IEN								
B M	B M	B M	OHIO UNIVERSITY	ATHENS	OH	45701	85	20
SIS PROGRAM IN DEPT OF IEN								
B	B	B	LOUISIANA TECH UNIVERSITY	RUSTON	LA	71270	108	0
SIS PROGRAM IN DEPT OF SIS								
B M D	B M D	B M D	VANDERBILT UNIVERSITY	NASHVILLE	TN	37240	100	25
SYS PROGRAM IN DEPT OF CSC								
M	M	M	LA STATE U AND A&M C	BATON ROUGE	LA	70803	0	26

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